

# John Day Basin Research Monitoring and Evaluation Pilot Project

## Phase I Report, Monitoring Data Dictionary Review June 1, 2004



**U. S. Bureau of Reclamation,**  
Pacific Northwest Regional Office  
**Spatial Dynamics Inc. and commonthread inc.**  
Boise, Idaho                      Boise, Idaho

**JOHN DAY BASIN  
RESEARCH, MONITORING AND EVALUATION (RME)  
PILOT PROJECT**

**Phase 1 Final Report**

**JUNE 1, 2004**

## TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY .....	1
1.1	PROJECT OBJECTIVES.....	1
1.2	CURRENT SITUATION .....	1
1.3	TARGET VISION.....	2
1.4	PROPOSED NEXT STEPS.....	3
1.5	LIST OF ACRONYMS .....	3
2.0	INTRODUCTION .....	5
2.1	BACKGROUND.....	5
2.2	RME PROJECT TEAM .....	5
2.3	SCOPE OF CURRENT PHASE.....	6
2.4	METHODOLOGY .....	7
3.0	BUSINESS CASE .....	8
3.1	BUSINESS DRIVERS .....	8
3.2	BUSINESS CONTEXT .....	8
3.3	BUSINESS PROCESS FLOW.....	10
3.4	FUNCTIONAL REQUIREMENTS.....	13
4.0	DATA REQUIREMENTS.....	15
4.1	INTRODUCTION.....	15
4.2	DEVELOPMENT OF THE DATA DICTIONARY.....	15
4.3	MASTER PROTOCOL LIST.....	15
4.4	RME DATA DICTIONARY.....	16
5.0	SYSTEM REQUIREMENTS.....	22
5.1	SOFTWARE REQUIREMENTS.....	22
5.2	HARDWARE REQUIREMENTS.....	22
6.0	PHASE 2 WORK PLAN AND DELIVERABLES .....	23
6.1	PHASE 2 OBJECTIVES .....	23
6.2	PHASE 2 RME DATA MANAGEMENT WORK PLAN.....	23

7.0 REFERENCES ..... 25

List of Appendixes

Appendix 1	Project Data
1-1	Researcher Contact List
1-2	Interview Notes
1-3	RME Group Meeting Notes
Appendix 2	Monitoring Protocols
Appendix 3	Protocols and References
Appendix 4	Sample Field Form – Stream Verification
Appendix 5	Monitoring Data Dictionary Help Document
Appendix 6	Data Dictionary

List of Figures

Figure 1	Target Vision
Figure 2	Business Context Diagram
Figure 3	Empirical Method Road Map
Figure 4	Data Management Conceptual Framework
Figure 5	RME Actor Roles
Figure 6	Indicator Group - Classification
Figure 7	Indicator Group - Biology
Figure 8	Indicator Group – Habitat/Physical

## 1.0 EXECUTIVE SUMMARY

### 1.1 PROJECT OBJECTIVES

In November 2003, the U.S. Bureau of Reclamation (Reclamation) contracted with Spatial Dynamics and commonthread incorporated to conduct a business needs analysis for the John Day Basin Research, Monitoring and Evaluation (RME) Pilot Project. This report documents the results of Phase 1 of this analysis.

The objectives of the business analysis are outlined in the 2003 draft document Appendix F: Data Management Workgroup Plan (RME Data Management Work Group, 2003). As stated in Appendix F, the primary purpose of this project is to develop a common system that will allow efficient and effective collection, management, and distribution of information relating to RME needs, while ensuring that the system will be compatible with fish and wildlife data requirements throughout the Columbia River basin.

However, because the overall RME data management objectives defined in Appendix F exceeded the scope and schedule allocated for the Phase 1 business analysis, the analysis objectives were modified to focus on a subset of the overall data management objectives.

This subset included:

- ❑ Selection of the common protocols and techniques that are to be developed and used for data collection, development, storage, and distribution.
- ❑ Selection of methods to ensure that data can be shared across agencies as needed for timely analysis.
- ❑ Definition of standards for properly documenting metadata for published data and information. Standards will include data pedigree and metadata and clearly distinguish primary data and derived information.

The remaining objectives outlined in Appendix F will be addressed during Phase 2.

### 1.2 CURRENT SITUATION

At this time, neither the Columbia Basin as a region nor the action agencies as a group has adopted standards for overall data management system development or for individual information system components.

Two RME pilot projects are currently underway in the Columbia Basin: the Upper Columbia and the John Day. A monitoring strategy for the Upper Columbia has been developed with the assistance of the draft Monitoring Strategy for the Upper Columbia Basin (Hillman, 2004). The document addresses the research questions and the identification of monitoring protocols and methodology.

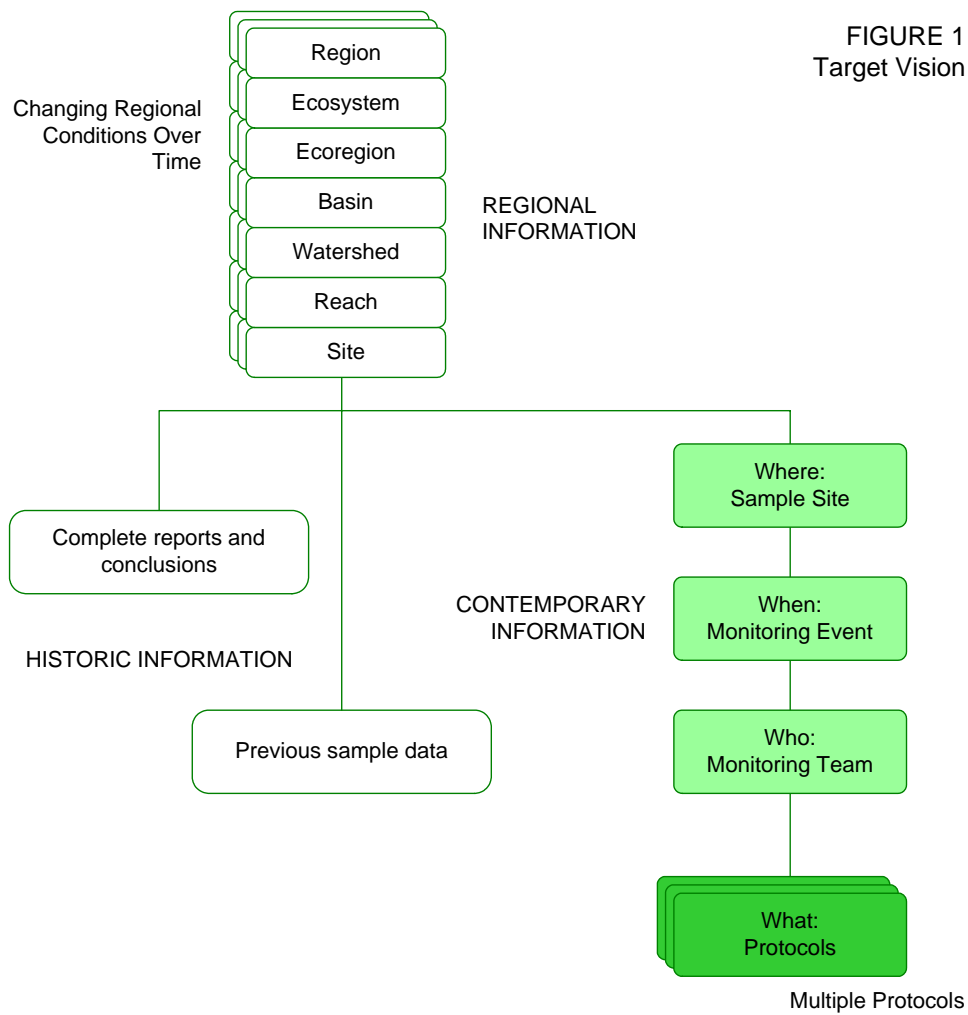
The John Day project has used the Monitoring Strategy as the basis for development of a data dictionary. The dictionary defines the data required to implement the RME protocols that are addressed in that document.

### 1.3 TARGET VISION

The RME target vision calls for development of a data dictionary (database entry list) that completely defines all data required for the protocols addressed in the Monitoring Strategy. The data dictionary is a foundation for development of the geospatial database model that will be developed in Phase 2. This database model will address the need for geospatial reference standards that use repeatable standard methods. Figure 1 indicates the major information components that have been identified for inclusion in the RME database system. In its complete form, the database is expected to include:

- ❑ Regional information.
- ❑ Historic information.
- ❑ Contemporary information.

Work in Phase 1 concentrated on defining the data dictionary for contemporary data. The database components addressed in Phase 1 are highlighted in green in Figure 1. The darker green shading indicates those elements that received the primary emphasis.



Regional information includes all data that defines the context – the conditions and environment – for a specific stream reach or sample site. This descriptive information includes hydrograph, watershed, and drainage basins, as well as geopolitical information. Regional information also includes the complete range of resource inventory and condition information, including elevation models, vegetation cover, land use, population, climate, etc. Combinations of resource data sets can be used to define ecoregions and to support resource and hydrologic modeling and characterization.

Historic data encompasses all historic hydrologic information, as well as historic watershed, hydrologic, and fisheries investigational data. A precise separation between historic and current information has not been established. Availability of appropriate supporting information, metadata, will be a major deciding factor. Historic data may also include historic regional information such as historic land cover and use or historic stream channels.

Contemporary information includes data that is collected as part of ongoing investigations as well as during future investigations and sampling programs. This will also include information collected in the recent past. As with the historic information, the criteria for contemporary information will be the availability of metadata as well as the use and correct application of the appropriate sampling protocols.

#### 1.4 PROPOSED NEXT STEPS

Review and approval of the data dictionary by the subject matter experts is critical. This effort is underway at this time and is expected to be complete prior to the Phase 2 kickoff meeting. Phase 2 will address the RME data management objectives defined in Appendix F that were not performed during Phase 1. The scope and objectives of the Phase 2 program are discussed in Section 6 of this report.

#### 1.5 LIST OF ACRONYMS

The following acronyms are used in this report and appendixes:

AFG	Analytical Framework Group
BPA	Bonneville Power Administration
CBCIS	Columbia Basin Cooperative Information System
CRUD	Create – Read – Update – Delete
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
ESU	Evolutionary Significant Unit
FCRPS	Federal Columbia River Power System
FLIR	Forward-Looking Infra-Red
GDB	Geographic Database
GIS	Geographic Information System
ISRB	Independent Science Review Board
NED	Northwest Environmental Data Network
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NWPCC	Northwest Power and Conservation Council
OAR	Office of Oceanic and Atmospheric Research
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OWEB	Oregon Watershed Enhancement Board
PNAMP	Pacific Northwest Aquatic Monitoring Program
RME	Research, Monitoring, and Evaluation
RPA	Reasonable and Prudent Alternative
RTT	Regional Technical Team
SME	Subject Matter Expert
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service

## 2.0 INTRODUCTION

### 2.1 BACKGROUND

The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) completed the Federal Columbia River Power System (FCRPS) Biological Opinion in December 2000. A comprehensive Implementation Plan was subsequently developed to carry out the directives of the Opinion. A multi-agency Research, Monitoring, and Evaluation (RME) work group was established to address overall data management requirements to support agency programs throughout the Columbia River basin. This effort is primarily driven by the Reasonable and Prudent Alternative (RPA) that requires that all agencies and other governmental entities working within the basin operate within the framework of a common data management system for evaluation and monitoring of fish populations, water quality, and habitat data.

The data management team is a component of the larger RME work group. The team consists of the U.S. Bureau of Reclamation, NOAA Fisheries, and the Action Agencies. The team's overall objective is to develop data collection strategies that will support the RPA requirement for a common data management system, and that will accommodate the data attributes, collection protocols, methods, standards, user groups, and reporting requirements defined by other RME subgroups. The subgroup also plans to work with the proposed Columbia Basin Cooperative Information System as it develops to establish a common regional system architecture and data standards.

As a part of its initial research, the data management subgroup convened a team of experts to consider overall RME challenges and recommend strategies. The findings of the group are included in the data management plan strategy outlined in this Phase I final report.

### 2.2 RME PROJECT TEAM

Michael Beaty, Pacific Northwest Region, Bureau of Reclamation, is the primary government lead for the project. Kim Johnson, Spatial Dynamics, is the contractor's project manager. Project team members include:

#### Core Team

- |                                |                                     |
|--------------------------------|-------------------------------------|
| ❑ Bureau of Reclamation:       | Michael Beaty, Melanie Paquin Boler |
| ❑ Spatial Dynamics:            | Kim Johnson, Shane Hopkins          |
| ❑ commonthread (subcontractor) | Michele Tae                         |

#### Subject Matter Experts

- |                          |                                |
|--------------------------|--------------------------------|
| ❑ Bureau of Reclamation: | Michael Newsom, Greg Gault     |
| ❑ NOAA:                  | Stewart Tolshach, Chris Jordon |

Meeting notes reflecting group meetings are presented in Appendix 1 of this report.

### 2.2.1 Project Contact List

The individuals and agencies listed below also participated in the RME project:

<input type="checkbox"/> Michael Newsom	U.S. Bureau of Reclamation
<input type="checkbox"/> Mike Beaty	U.S. Bureau of Reclamation
<input type="checkbox"/> Lanie Paquin-Boler	U.S. Bureau of Reclamation
<input type="checkbox"/> Greg Gault	U.S. Bureau of Reclamation
<input type="checkbox"/> Chris Jordan	NOAA Marine Fisheries
<input type="checkbox"/> Stewart Toshach	NWPPC/NOAA Marine Fisheries
<input type="checkbox"/> Rich Henderson	U.S. Forest Service
<input type="checkbox"/> Don Butcher	Oregon DEQ
<input type="checkbox"/> Shannon Hubler	Oregon DEQ
<input type="checkbox"/> Kim Jones	Oregon DFW
<input type="checkbox"/> Hiram Li	Oregon State University
<input type="checkbox"/> Tim Unterwegner	Oregon DFW
<input type="checkbox"/> Jim Ruzycki	Oregon DFW
<input type="checkbox"/> Tracy Hillman	BioAnalysts, Inc.
<input type="checkbox"/> Michael Ward	Terragua, Inc.
<input type="checkbox"/> Russ Faux	Watershed Sciences

### 2.2.2 Project Meetings

The group meetings listed below were conducted during Phase 1:

<input type="checkbox"/> October 16, 2003	Project Kick-off Meeting, Boise, Idaho
<input type="checkbox"/> November 14, 2003	Habitat Working Group Meeting, Portland, Oregon
<input type="checkbox"/> February 25, 2004	Biological Working Group Interview, La Grande, Oregon (see interview notes in Appendix A)
<input type="checkbox"/> March 10, 2004	Biological Working Group Interview, La Grande, Oregon (see interview notes in Appendix A)
<input type="checkbox"/> March 30, 2004	Data Dictionary Review Meeting, Portland, Oregon.
<input type="checkbox"/> April 16, 2004	Data Dictionary Review Meeting, Leavenworth, Washington

## 2.3 SCOPE OF CURRENT PHASE

As previously stated, neither the Columbia Basin as a region nor the action agencies as a group has adopted data management or information system standards at this time. To the extent that agencies do have standards in place, they are not uniformly applied. The Columbia Basin Cooperative Information System (CBCIS) project proposes to address the need for standards, and, if there is support for a regional approach, development of standards and protocols is likely to be a key priority. It is possible that the CBCIS project will establish data standards in time for incorporation into the RME program. If this does not occur, however, the RME team must adopt standards independently to meet established project milestones.

Two RME pilot projects are currently underway in the Columbia Basin: the Upper Columbia and the John Day. A monitoring strategy for the Upper Columbia was developed with the assistance of the Monitoring Strategy for the Upper Columbia Basin (Hillman, 2004). The document addresses the research questions, the identification of monitoring protocols and methodology.

The John Day project does not yet have a defined monitoring strategy. There is a shared assumption held by management and subject matter experts (Chris Jordon, Michael Newson, et al.) that the protocols stated in the Monitoring Strategy can address the needs of the John Day. However, the Upper Columbia project, while it has embraced a monitoring strategy, does not have a data dictionary. Therefore, the development of the data dictionary for Phase 1 complements the overall RME data management effort now underway in the Columbia Basin.

## 2.4 METHODOLOGY

The methods used to develop the data dictionary involved research and identification of protocol references contained in the Monitoring Strategy. A preliminary use case model was developed to support assessment of information needs for the John Day. The full needs assessment process will be conducted during Phase 2.

The methods used to develop the data dictionary involved research and identification of the protocol references contained in the Monitoring Strategy. The data dictionary is based on sampling and analysis protocols. The dictionary lists the data elements used by each protocol. Each protocol was evaluated using the documents cited in the Monitoring Strategy or a parent citation when the direct citation could not be obtained.

The protocols are divided into three major monitoring indicator groups: Classification, Biological, and Habitat/Physical. The monitoring plan defines a group of general characteristics that will be addressed within an indicator group. Each general characteristic comprises one or more associated specific indicators. The organization hierarchy is:

- Indicator groups, which include:
  - General characteristics, which include:
    - Specific indicators, consisting of a number of attributes:
      - Attributes are individual data elements, and are equivalent to attributes (columns) in a relational database.

The data dictionary presented in Appendix 6 and the Access database that supports the data dictionary follow this organizational hierarchy.

### 3.0 BUSINESS CASE

#### 3.1 BUSINESS DRIVERS

##### 3.1.1 Goals and Objectives

The business drivers for this project call for the following goals to be met:

- ❑ Identification of common protocols and techniques for the collection of RME data within the John Day Basin.
- ❑ Development of mechanisms for common storage and distribution of RME data across multiple agencies.
- ❑ Establishment of a means to ensure that data can be shared as needed for timely analysis.

##### 3.1.2 Critical Success Factors

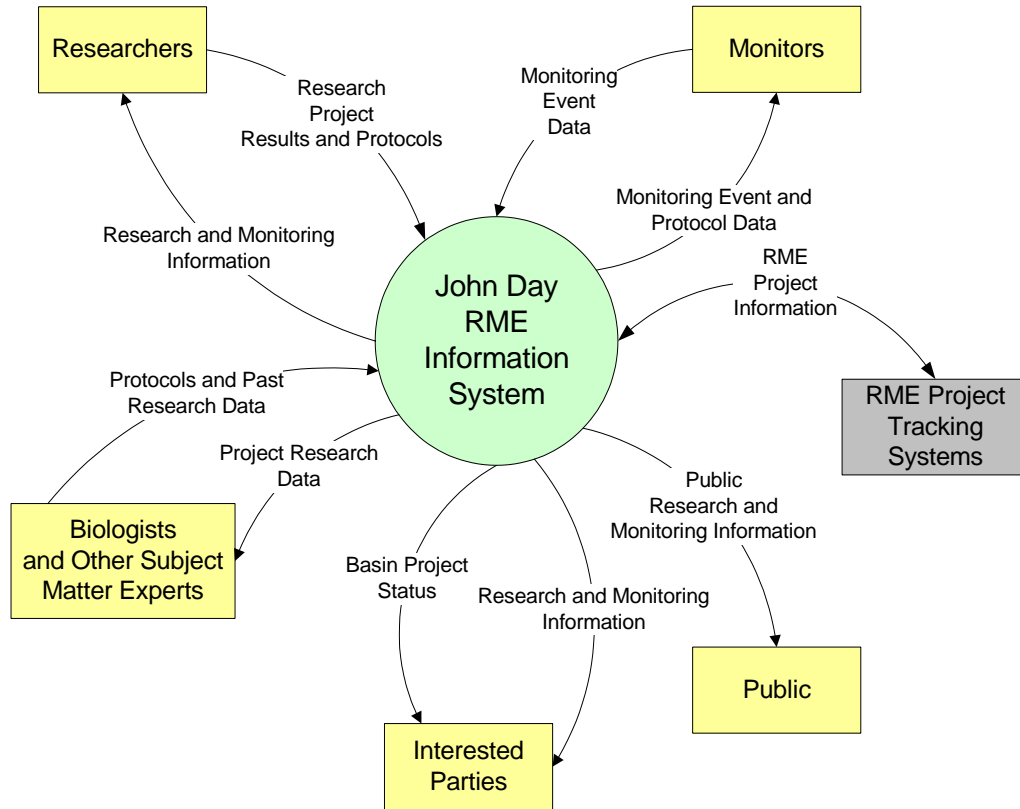
Completion of the goals outlined above will be assessed in terms of this critical success factor:

*Acceptance of the common protocols by the stakeholders that represent local, state, tribal, and federal agencies (EPA, USFS, FWS, NMFS, BPA, et al.), as well as independent research institutions and individuals.*

#### 3.2 BUSINESS CONTEXT

The needs assessment process included identification of the external stakeholders who will exchange information with the John Day RME information system. Figure 2, Business Context Diagram, and its accompanying table identify the stakeholders and document the flow of information. The information flows are identified at the conceptual level and are not meant to define the detailed data. Information that is sent to the JD RME system is required from the stakeholder and information that flows from the John Day RME information system is provided to the stakeholder. The table further defines the information provided in the diagram.

FIGURE 2  
Business Context Diagram



Stakeholder Group	Information sent to the stakeholder	Information received from the stakeholder
Biologists and other SMEs	RME data collected from research projects	Results of past research projects and RME protocol definitions
Monitors (field staff)	Monitoring event schedule and set of required protocol data	Monitoring event data collected in the field
Interested parties	RME information and Columbia Basin project status	No direct information flow
Public	Public RME information	No direct information flow
Researchers	Data collected from research projects	Results of past research projects and standard protocol definitions
RME project tracking system	Status of RME projects	Unique identification of RME projects

### 3.3 BUSINESS PROCESS FLOW

#### 3.3.1 Empirical Method Road Map

The Empirical Method Road Map, shown in Figure 3, illustrates the business processes to be supported by the John Day RME system. This document will serve as a conceptual framework for geospatial information to be used to coordinate research efforts in the John Day Basin.

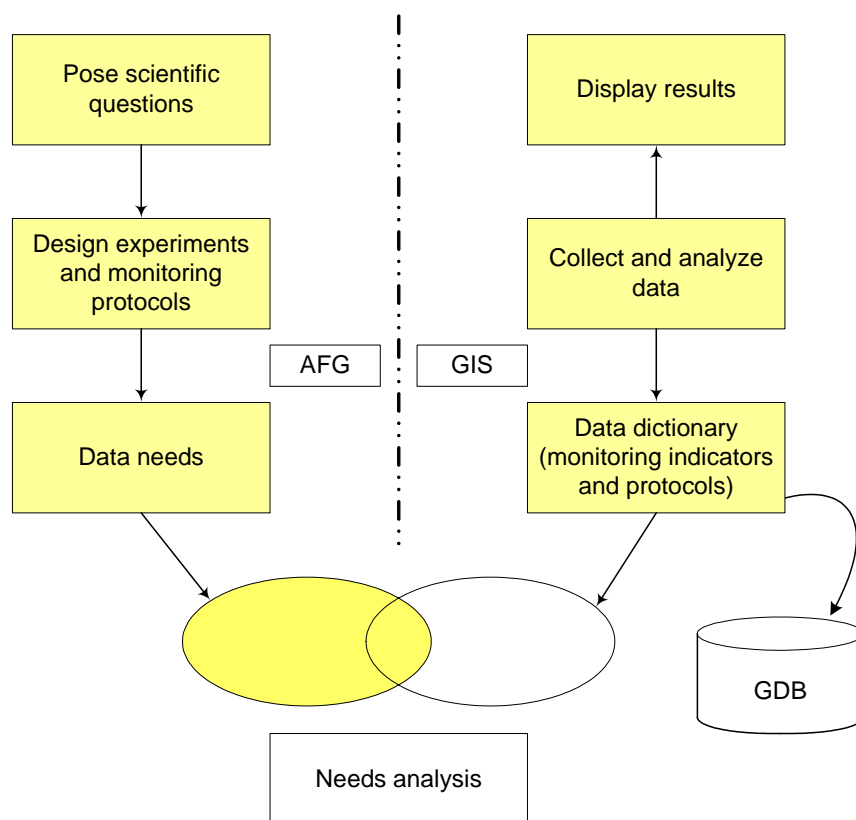


FIGURE 3  
Empirical Method  
Road Map

The road map illustrates the general data management process that the FCRPS (Federal Columbia River Power System) RME program has adopted. The Analytical Framework Group (AFG) within the FCRPA is responsible for formulating the scientific questions and designing studies (experiments) to resolve them. Identifying data needs is a critical subtask in the study design. The GIS group is assigned to develop an information infrastructure to support data collection and analysis and to display results.

The GIS work includes construction of the data dictionary, which is a tool that provides a comprehensive conceptual data management framework based on the selected monitoring indicators and data collection protocols. The John Day RME data dictionary is largely based on the Monitoring Strategy for the Upper Columbia Basin (Hillman, 2004). It will contain the monitoring data now being collected within the John Day Basin by various organizations.

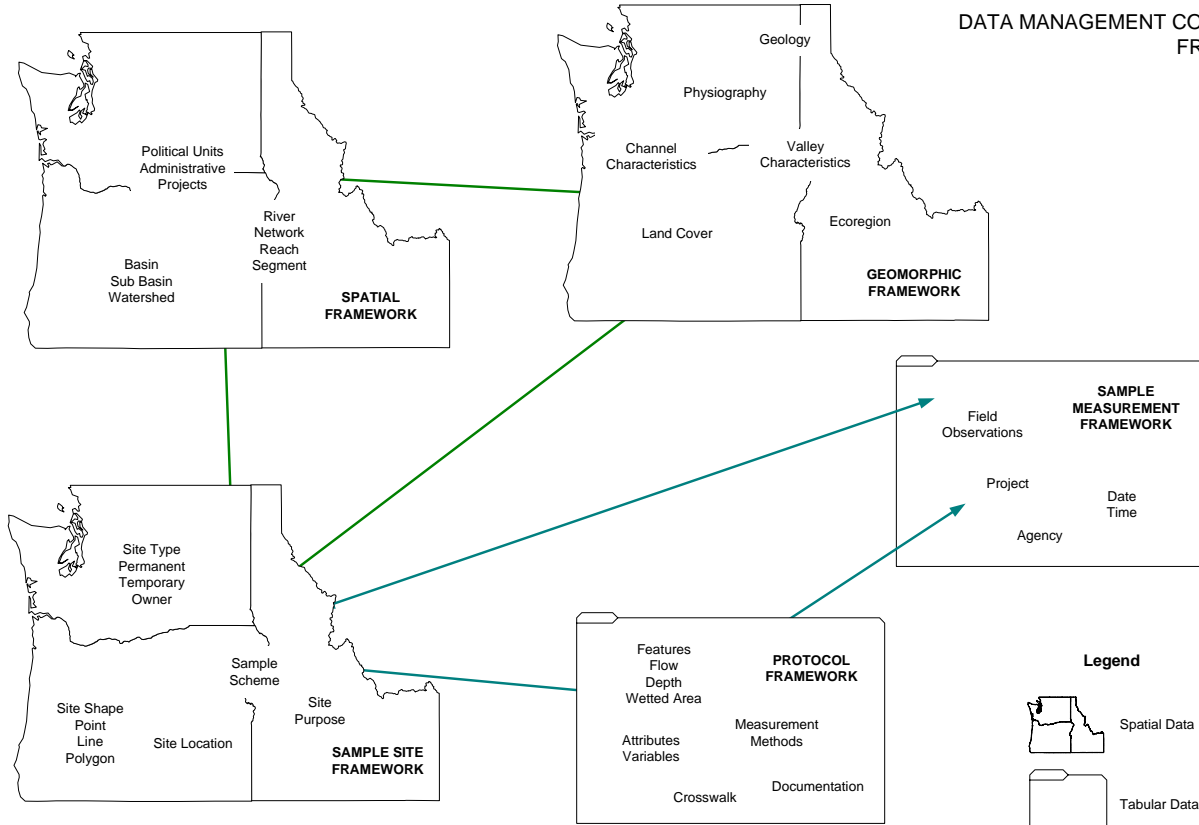
The GIS group will use the data dictionary as the foundation for a logical and physical design for the geodatabase (GDB) container that will host the RME data. Phase 2 of the John Day RME needs analysis will examine the data dictionary to determine if existing data is adequate for the proposed studies. If data gaps are found, additional indicators or protocols could be added to the data dictionary and appropriate modifications made to the geodatabase. To be accepted as an effective information system across the Columbia Basin, future modifications to the data dictionary and the geodatabase design will require a formalized process through an established approving committee.

### 3.3.2 Data Management Conceptual Framework

The conceptual data management framework, shown on Figure 4, is a conceptual framework for organizing the RME database components and variables. The framework includes:

- ❑ Spatial Framework, consisting of all spatially organized indexing and references information, including the hydrographic system, geopolitical boundaries, land ownership and management boundaries, and any other administrative units that may be defined.
- ❑ Geomorphic Framework, including the base-level natural resource data as well as derived resource characterization information. The geomorphic framework is spatial and contains information such as elevation and terrain, soils, vegetation cover, land use, modeling results, and resource characterization.
- ❑ Sample Framework, addressing specific sample sites, most of which will be associated with the hydrologic network. The sample framework supports all information about locations where data is collected and includes specific sample points, cross-sectional transects, stream reach sample sites and X-sites. The X-sites are based on EPA EMAP sampling protocols.
- ❑ Protocol Framework, describing the organization and specifications of each protocol that is used to collect field data. The protocol framework is also the basis for developing and managing sampling meta data. All field data are associated with a protocol.
- ❑ Sample Measurement Framework, used to manage and report the field data. The sample measurement framework is the heart of the RME information system, providing information to be used by investigators to answer specific questions as well as to document changing conditions over time.

FIGURE 4  
DATA MANAGEMENT CONCEPTUAL  
FRAMEWORK



As shown in Figure 4, there are two major associations or zones in the data management framework. The first association links the sample sites, protocols, and sample data. It is a spatial and tabular data association. Sampling data is collected at a known sample site following a defined protocol that allows for database management and reporting of sampling results. The second association is spatial, and links the sample site, and therefore the sampling results, to the ecoregion and resource base as well as to the organizational and administrative framework.

The data management framework supports the independent organization and analysis of RME data. The information in each framework can be changed and updated without modifying other parts of the information system. Administrative boundaries can be modified and new layers added to the RME database. Following the addition of the new administrative units, sampling, analyses, and trend information can be generated for the new areas of interest without additional changes to the database. The same level of flexibility applies to the geomorphic framework. As additional geomorphic information, such as a new ecoregion classification, is developed, sampling data can be easily accessed and analyzed based on the new regional definitions.

### 3.4 FUNCTIONAL REQUIREMENTS

As previously stated, Phase 1 of the John Day RME analysis focused on the data dictionary, and did not define detailed system or business functional requirements. Business-level use cases were defined primarily as placeholders for Phase 2 of the needs assessment.

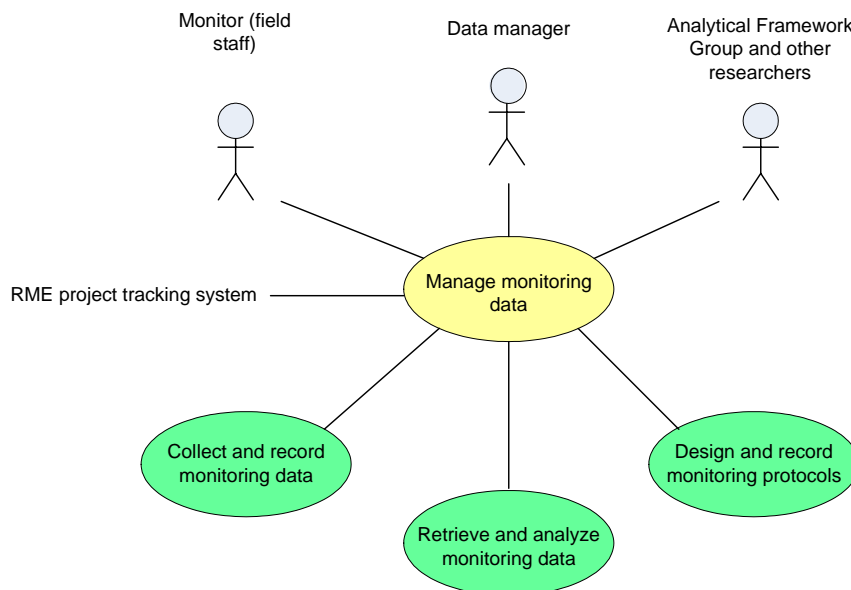
A use case defines an interaction between an actor (system user) and the information system. An actor plays a role in the overall business process, and each interaction defines a goal. The use case goal is achieved through the process described as a flow of events in the use case. A use case model normally contains a use case diagram and use case description.

The process of defining use cases begins with by identifying actors, goals, and brief descriptions of the flow of events (referred to as a use case brief). During Phase 2, each use case brief will be developed into a full use case with more detailed attributes.

#### 3.4.1 Actors

The actors defined for the John Day RME system include a data manager, monitors, and researchers, as shown in Figure 5. As part of the research community, the AFG (described in Section 3.3, Business Process Flow) plays a critical role by defining the standard protocols to be used for collecting RME data.

FIGURE 5  
RME ACTOR ROLES



Actor	Role
Data manager	Responsible for maintaining the system lookup and project data.
Monitors (field staff)	Responsible for collecting monitoring data in the field relative to RME projects.
Analytical Framework Group and other researchers	Responsible for establishing standard RME protocols and disseminating RME results in the research community.

#### 3.4.2 Use Case Briefs

Goal	Actor	Use Case Brief
Manage monitoring data	Data manager	Import RME project tracking system data. Ensure that RME projects are accurately identified and defined from the Project Tracking System.
Record monitoring data	Monitors (field staff)	Identify time, location, protocol, and sampling design. Record values for data collected in the field.
Retrieve and analyze monitoring data	Researchers	Identify data to be retrieved. Export identified data for analysis.
Design and record monitoring protocols	Researchers (AFG)	Design protocol and add to protocol catalog. Record data required by the protocol.

## 4.0 DATA REQUIREMENTS

### 4.1 INTRODUCTION

The major Phase I work product is the data dictionary, which is presented in Appendix 6 of this report. The data dictionary is designed to enable scientists performing watershed research, including fish monitoring, FLIR analysis, Landsat analysis, and TMDL (Total Maximum Daily Load), to deposit, view, and distribute data within a single source. The general approach is to define or develop a technical reference that specifies how the indicator information is to be collected and what information will be recorded. Technical specifications are used to describe the individual protocol data elements that make up the data dictionary.

### 4.2 DEVELOPMENT OF THE DATA DICTIONARY

The dictionary was developed based on the RME scope of work prepared in December 2003. The task description is shown below.

Task 2.1.3: the determination of a master protocol list for building the data dictionary will be conducted by the Bureau.

1. The list will be viewed as a 'work in progress' that will be continuously developed throughout the course of the project and finalized before project completion. The master list will be cross-referenced to the project data dictionary.
2. Spatial Dynamics has developed the master protocol list based on the Monitoring Strategy for the Upper Columbia Basin (Hillman, 2004).
3. Spatial Dynamics will develop a data dictionary for the attributes contained in each protocol.
4. The protocol list will be validated with the Core Team and other interested parties during the week of March 22<sup>nd</sup>, 2004.

### 4.3 MASTER PROTOCOL LIST

The master protocol list contains all of the protocols included in the data dictionary as well as the technical references used to define the individual protocol data elements. The list was developed to identify and track the protocols that will be included in the data dictionary and pilot information system.

The master protocol list is based on the sampling protocols and references listed in the Monitoring Strategy for the Upper Columbia Basin (Hillman, 2004). The table presented in Appendix 2 lists the monitoring protocols. The protocol list identifies:

- ❑ General Characteristics – Each of the major monitoring themes (Thema in Monitoring Strategy).
- ❑ Indicator – The feature or characteristic being measured.
- ❑ Reference – The technical reference for the protocol.
- ❑ Subject Area – The topical subject area associated with a protocol.
- ❑ Spatial Scale – The area of reference or sampling for each protocol.

- ❑ Framework – The grouping of protocols by regional/geomorphic, watershed network or specific sample sites.
- ❑ Data Structure – The general structure of the protocol data.
- ❑ Sampling Frequency – How frequently each protocol will be measured according to the monitoring strategy.

Appendix 3 lists each of the protocols and references used to develop the protocol data elements that comprise the data dictionary.

#### 4.4 RME DATA DICTIONARY

A formal specification for a data dictionary is a *‘repository of information describing the characteristics of data used to design, monitor, document, protect, and control data in information systems and databases’* (Open Group, 2000). The objective of the RME pilot project data dictionary is to identify and list all of the data elements needed to capture and document the identified protocol data.

The data dictionary is a model that consolidates biological indicators, classification variables, and habitat and physical characteristics into a single system. It is not normalized, and should not be considered as a final database entity relationship design specification. There will be some redundancy among various data elements. The dictionary defines what information needs to be collected for each protocol. It does not define the overall data management program, including data collection and review. These issues will be addressed by the final database design.

##### 4.4.1 Phase 1 Data Dictionary Development

An Access database was developed to manage the data dictionary. Currently, the RME pilot data dictionary contains over 1,100 entries. The complete data dictionary is included in Appendix 6. The Access database is also included with this report. The database includes tools, forms, and reports to allow interactive navigation and review of the data dictionary.

After the database was developed, the dictionary was constructed using the general format and protocols found in the references listed in the Monitoring Strategy (Hillman 2004). Protocols were also gathered from the Environmental Monitoring and Assessment Program (EMAP) developed by the U.S. Environmental Protection Agency (EPA). The data dictionary database attributes are:

- ❑ Indicator Group – Major subject areas for organizing RME data. The design has identified three data groups: Classification, Biological, and Habitat/Physical. The indicator groups are stored in the database as INDICATOR.
- ❑ General Characteristics – Text variables describing certain groupings of characteristics within the database, and an explanation describing the need for strict adherence to correct standards and procedures for collection and organization of information. These are stored in the database as PROTOCOL.
- ❑ Specific Indicator – Organizational variables for protocols that consider land-use activities or stresses; these are consistent with other regional monitoring programs and provide reliable

measurements. They are associated with a specific published or documented protocol, and are stored in the database as VARIABLE.

- ❑ Domain – Arena of inclusion; describes an overall setting for a sampling area of interest. This can be a region, watershed, stream reach, X-site sample, or a discrete sample point.
- ❑ Attribute – Individual variables that, when combined, help to describe, define, and answer protocol issues. Groups of attributes make up complete protocols.
- ❑ Units – Standard of measurement for each individual attribute, based on the characteristics of that particular attribute.
- ❑ Data Type – Defines the internal data storage type that will be used for each attribute.
- ❑ Precision – Examples of the level of precision required.
- ❑ Description – An illustrative statement of what each individual attribute represents.
- ❑ Comment – Further explanations or observations about each individual attribute.
- ❑ SDComments – Comments made by the Spatial Dynamics team and other individuals advising on particular attributes.
- ❑ Hyperlink – Links to outside sources for further explanation or information.

#### 4.4.2 Data Dictionary Structure

Within the data dictionary, the specific indicator to be measured is the primary element. Specific protocols for each indicator are used to define how the data is collected as well as which data elements are included in the database. The specific indicators are grouped within a series of general characteristics, which in turn are organized into indicator groups, as shown on Figures 6, 7, and 8, which follow.

FIGURE 6  
Indicator Group –  
Classification

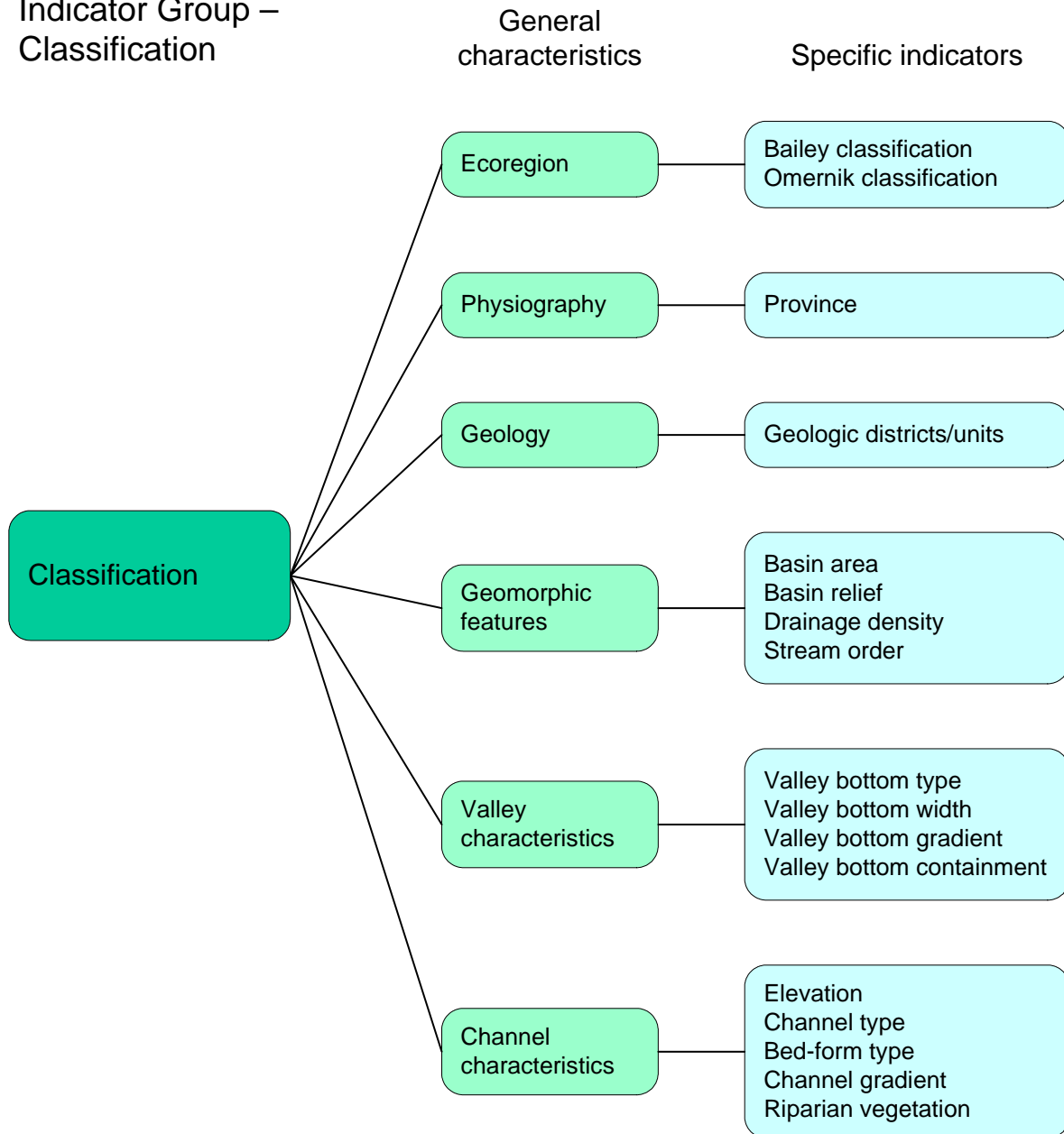


FIGURE 7  
Indicator Group –  
Biological

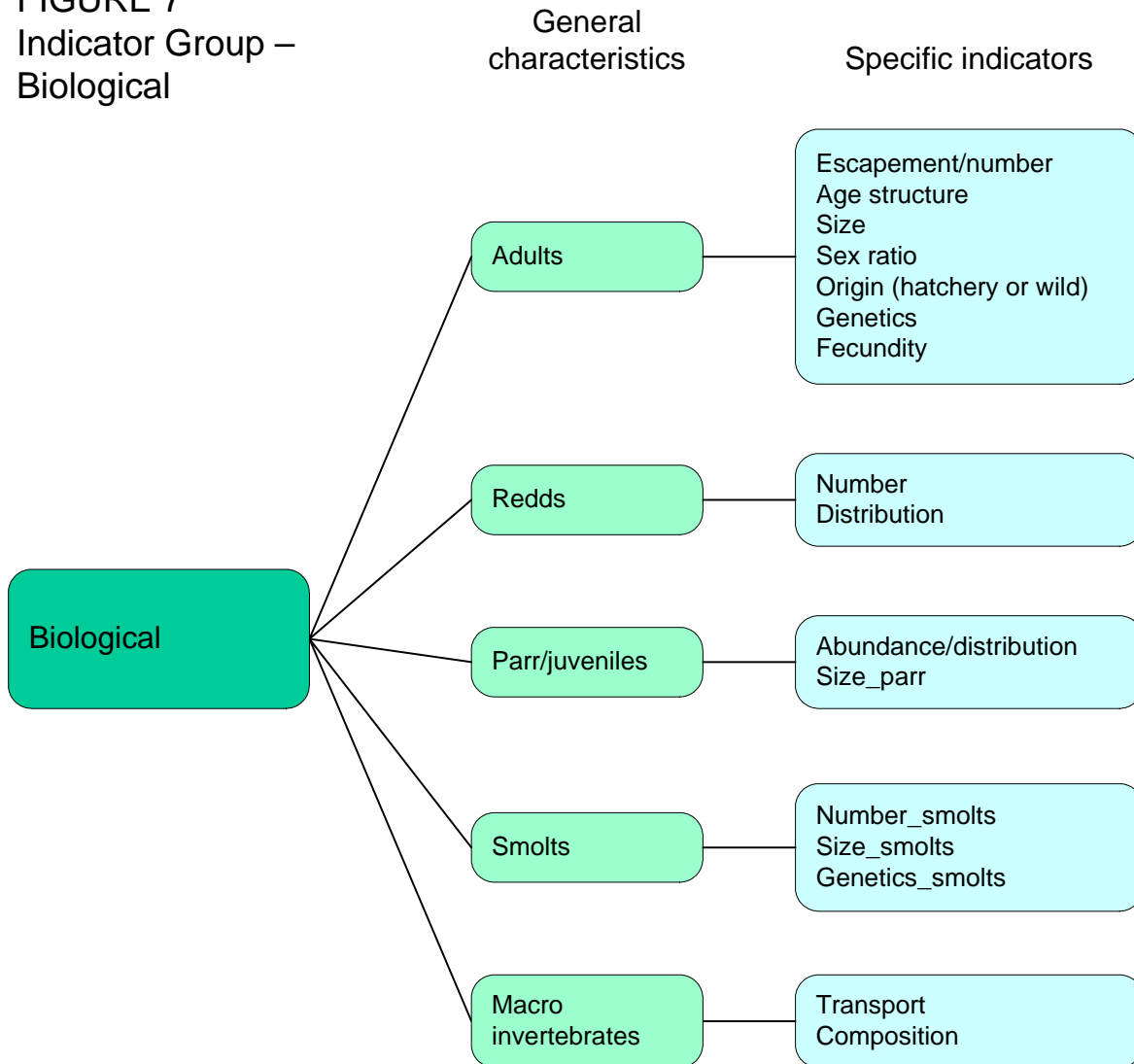
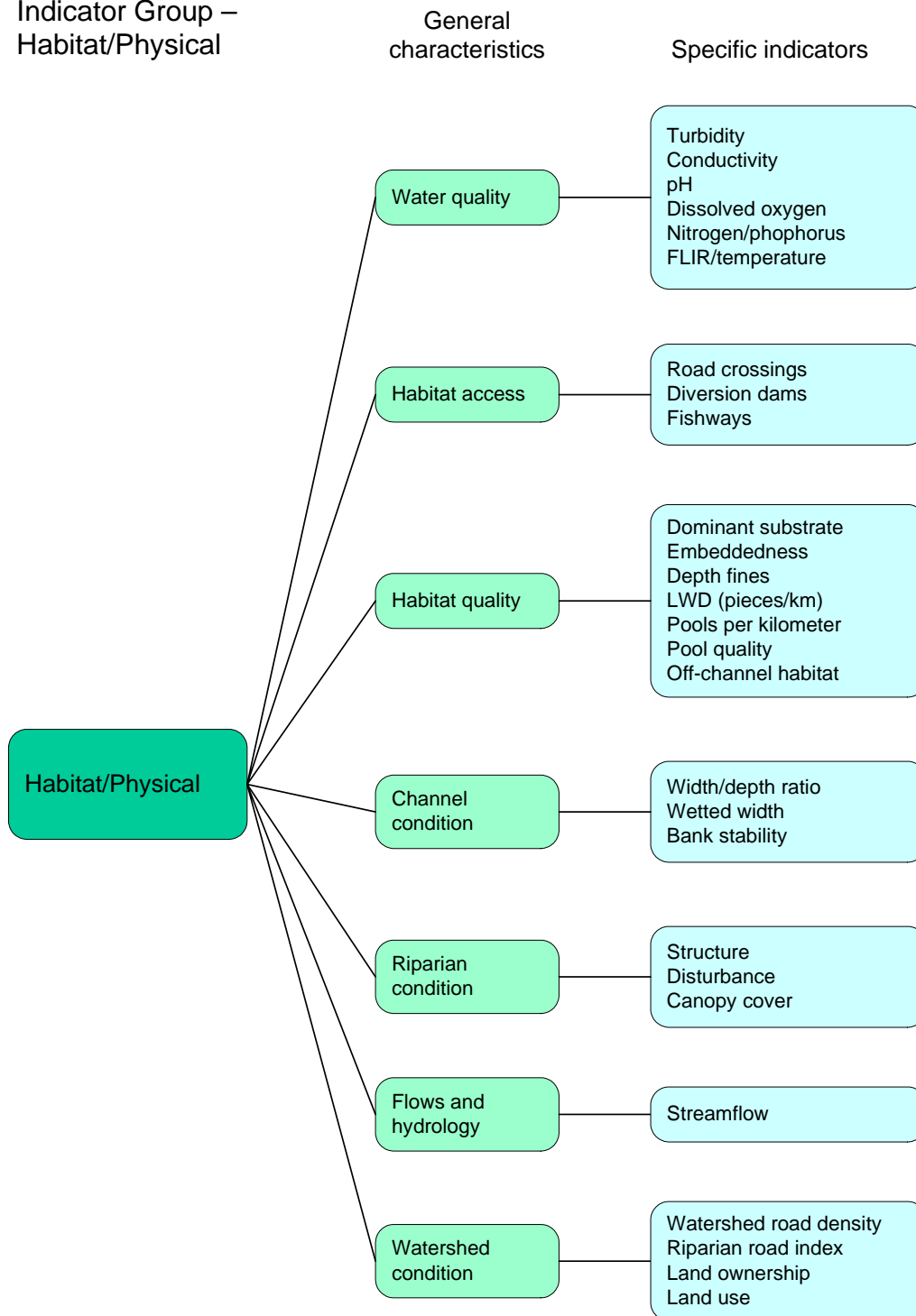


FIGURE 8  
Indicator Group –  
Habitat/Physical



The data dictionary lists the individual attributes that will be used to define and manage the detailed data for each specific indicator protocol. The indicator attributes can be used to develop a detailed database entity-relationship model as well as to build tabular forms for recording the indicator data. The Stream Verification form included in Appendix 4 is a sample form that was developed in Access using the data dictionary information to verify a stream sampling site.

#### 4.4.3 Data Dictionary Support

Appendix 5 contains a brief Help document, entitled Field Monitoring Data Dictionary Help Document (rme\_datadict\_050504). This Help document directly supports the operation of the user interface created within Microsoft Access to view the data contained in the RME data dictionary.

## 5.0 SYSTEM REQUIREMENTS

### 5.1 SOFTWARE REQUIREMENTS

Final software requirements for the John Day Pilot Project system will be determined based on the conclusions of Phase 2.

Basic system requirements identified at this time are:

- ❑ Single user/applications database: Microsoft Access 2000/XP.

The John Day Data Dictionary is in Microsoft Access.

- ❑ GIS environment: ESRI ArcGIS 8.3.

The ArcGIS environment includes all of the ESRI GIS tools: ArcCatalog, ArcView, ArcMap, Arc Toolbox, and Spatial Analyst, as well as the Spatial Database Engine (SDE). It is expected that the GIS software versions will migrate to the most recent ESRI software release. The release of ArcGIS 9.0 is imminent (second quarter 2004).

- ❑ Internet mapping services:
  - ArcIMS 4.0
  - Moxi Media Internet Mapping Framework

System requirements to be determined are:

- ❑ Enterprise database engine: Oracle 8.7.

The enterprise database supports Geodatabase components using the Spatial Database Engine (SDE). SDE can be operated using several different database servers, including Oracle, and Microsoft's SQL server. Oracle is the enterprise database system for the Bureau of Reclamation.

### 5.2 HARDWARE REQUIREMENTS

The hardware requirements for the John Day Pilot Project have not yet been addressed. It is expected that the fully implemented system will include both server and client services.

Because of the number and distribution of users in the Pacific Northwest, a distributed database system with several nodes will probably be used. Each node would support the data associated with the work underway at a particular site. Each node would be accessible by all system clients and servers. Retrieval of data from multiple nodes would be transparent to the typical system user.

Use of a distributed system assumes that full-service, broadband network infrastructure would be available to most if not all major users. The system would also support Internet-based dial-up access for casual users and the public.

## **6.0 PHASE 2 WORK PLAN AND DELIVERABLES**

### **6.1 PHASE 2 OBJECTIVES**

#### **6.1.1 System-Wide Data Management**

In accordance with the requirements set forth in the Biological Opinion and subsequent Appendix F draft document, these objectives will be addressed during Phase 2.

- ❑ Develop an overall RME information system architecture – a detailed blueprint of the design of the RME system.
- ❑ Take advantage of existing potential data centers. Include information portals/distributed database management system tools as necessary to consolidate data and communicate using the Internet.
- ❑ Develop a data management cost-sharing approach to achieve 2000 Federal Columbia River Power System (FCRPS) requirements.

#### **6.1.2 Data Management Prototype**

The goal of Phase 2 is to develop a data management program that clearly identifies research monitoring and evaluation data management needs for the John Day basin, with the cooperation of local, state, tribal, and Federal entities. Specific considerations include:

- ❑ Recognize the need to develop an information system from the ground up in a modular fashion so that the system meets the practical needs of the users while meeting pertinent legal and administrative requirements.
- ❑ Perform a scoping exercise, to include objectives, deliverables, timelines, and budgets for a prototype.
- ❑ Adopt geospatially referenced standards using repeatable standard methods. Where possible, make the data available as spatial data layers.
- ❑ Provide security for data, systems, and participant information where necessary.

### **6.2 PHASE 2 RME DATA MANAGEMENT WORK PLAN**

To meet the RME data management objectives listed above and defined in Appendix F, Phase 2 will incorporate the following tasks, which are more fully defined in Appendix F.

#### System-wide data management

- ❑ Review existing data management projects, goals, and needs in light of FCRPS goals and needs.
  - Include general goals for each participating entity.
  - Develop background information.
  - Define required data management system functions and needs.

- ❑ Develop a common FCRPS RME information system plan encompassing architecture, standards, and protocols.
  - Define necessary operational processes.
  - Define system architecture.
  - Define reporting standards.
  - Complete design review or build/test a prototype.
  - Define system specifications and documentation requirements.

#### Habitat pilot data management

- ❑ Scope pilot data management project.
  - Scope data resources.
  - Prioritize needs.
  - Develop a detailed project plan.
- ❑ Conduct pilot data management needs assessment.
  - Validate data needs outputs and model inputs.
  - Identify data protocols, spatial data layers, QA/QC procedures, etc. Identify standard data reporting protocols.
  - Review data for compatibility.
  - Refine data dictionary as required.
  - Identify initial business rules for operating the pilot information system.

## 7.0 REFERENCES

- Bain, M.B. and N.J. Stevenson, editors. Aquatic Habitat Assessment: Common Methods. American Fisheries Society, Bethesda, MD. 1999.<[www.fs.fed.us/land/ecosysmgmt/ecoreg1\\_home](http://www.fs.fed.us/land/ecosysmgmt/ecoreg1_home)>.
- BURPTAC (Beneficial Use Reconnaissance Project Technical Advisory Committee). Beneficial Use Reconnaissance Project Work Plan for Wadeable Streams. 1999. Idaho Division of Environmental Quality, Boise, ID.  
[http://www.deq.state.id.us/water/surface\\_water/99\\_burp\\_work\\_plan.pdf](http://www.deq.state.id.us/water/surface_water/99_burp_work_plan.pdf)>.
- Hawkins, C.P. and ten others. Hierarchical Approach to Classifying Stream Habitat Features. 1993. Fisheries 18:3-12.
- Hillman, T.W. Monitoring Strategy For The Upper Columbia Basin. Draft Report. 2004. BioAnalysts, Inc. Eagle, Idaho.
- Omernik, J.M. Aquatic Ecoregion of the Contiguous United States. *Annals of the Association of American Geographers* 77: 118-125. 1987.
- Open Group. Glossary. 2000. <http://www.opengroup.org/architecture/togaf7-doc/arch/p4/glossary/glossary.htm>.
- OPSW (Oregon Plan for Salmon and Watersheds). Water quality monitoring, technical guide book. Version 2.0. 1999 Corvallis, OR. <<http://www.oweb.state.or.us/publications/index.shtml>>.
- Overton, C. K., S. P. Wollrab, B. C. Roberts, and M.A. Radko. R1/R4 (Northern/ Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. *USDA Forest Service General Technical Report INT-GTR-346*, Ogden, UT. 1997.
- Parker, M.A. Fish Passage - Culvert Inspection Procedures. *Watershed Restoration Technical Circular No. 11*. 2000. Ministry of Environment, Lands and Parks and Ministry of Forest, British Columbia.
- Parmenter, A. W., A. Hansen, R.E. Kennedy, W. Cohen, U. Langener, R. Lawrence, B. Maxwell, A. Gallant, and R. Aspinall. Land Use and Land Cover in the Greater Yellowstone Ecosystem: 1975-1995. 2003. *Ecological Applications* 13:687-703.
- Peck, D.V., J.M. Lazorchak, and D.J. Klemm. Environmental Monitoring and Assessment Program-- Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. Draft Report. 2001. U.S. Environmental Protection Agency, Washington, D.C.  
<<http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html>>.
- RME Data Management Work Group, US Bureau of Reclamation. Appendix F: Data Management Workgroup Plan. Draft. 2003.
- Rosgen, D. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO. 1996.
- Schuett-Hames, D., R. Conrad, A. Pleus, and M. McHenry. Method Manual for the Salmonid Spawning Gravel Composition Survey. 1999b. Timber-Fish-Wildlife TFW-AM9-99-006, Northwest Indian Fisheries Commission, Olympia, WA. <<http://www.nwifc.wa.gov/TFW/documents.asp>>.

Torgersen, C.E., R.N. Faux, B.A. McIntosh, N. J. Poage, and D.J. Borton. Airborne Thermal Remote Sensing for Water Temperature Assessment in Rivers and Streams. 2000. *Remote Sensing of Environment* 76 (2001) 386-398.

WDFW (Washington Department of Fish and Wildlife). Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual. 2000. Olympia, WA. Washington Department of Fish and Wildlife Habitat Program, Environmental Restoration Division.  
<<http://wdfw.wa.gov/hab/engineer/fishbarr>>.

Wipfli, M.S. and D.P. Gregovich. Export of Invertebrates and Detritus From Fishless Headwater Streams in Southeastern Alaska: Implications for Downstream Salmonid Production. *Freshwater Biology* (2002): 47:957-969.

Zaroban, D.W. Protocol for Placement and Retrieval of Temperature Data Loggers in Idaho Streams. 2000. Boise, ID. Idaho Division of Environmental Quality.

APPENDIX 1-1  
RESEARCHER CONTACT LIST

# Appendix 1-1

## Researcher Contact List

	Name	Organization	E-mail	Telephone	City, State
<b>Habitat Protocol Group (Habitat Monitoring Team)</b>					
<b>Lead</b>	Rich Henderson	USFS	<a href="mailto:rhenderson01@fs.fed.us">rhenderson01@fs.fed.us</a>	435-755-3578	Logan, UT
	Don Butcher	Oregon DEQ	<a href="mailto:butcher.don@deg.state.or.us">butcher.don@deg.state.or.us</a>	541-278-4603	Pendleton, OR
	Shannon Hubler	Oregon DEQ	<a href="mailto:hubler.shannon@deg.state.or.us">hubler.shannon@deg.state.or.us</a>	503-229-5346	Portland, OR
	Kim Jones	ODFW	<a href="mailto:jonesk@fsl.orst.edu">jonesk@fsl.orst.edu</a>	x260	Corvallis, OR
<b>Analytical Framework Group (Scientific Questions and RME Sites)</b>					
<b>Lead</b>	Mark Bowen	USBR TSC	<a href="mailto:mbowen@do.usbr.gov">mbowen@do.usbr.gov</a>	303-445-2222	Denver, CO
	Peter Bayley	OSU	<a href="mailto:peter.bayley@oregonstate.edu">peter.bayley@oregonstate.edu</a>	541-737-0569	Corvallis, OR
	Phil Larsen	USEPA	<a href="mailto:larsen.phil@epa.gov">larsen.phil@epa.gov</a>	541-754-4362	Corvallis, OR
	Hiram Li	OSU	<a href="mailto:hiram.li@oregonstate.edu">hiram.li@oregonstate.edu</a>	541-737-1963	Corvallis, OR
	Tim Unterwegner	ODFW	<a href="mailto:tjunterwegner@centuryte.net">tjunterwegner@centuryte.net</a>	541-575-1167	John Day, OR
<b>Fish Measurement Group</b>					
<b>Lead</b>	Jim Ruzycki	ODFW	<a href="mailto:jruzycki@eou.edu">jruzycki@eou.edu</a>	541-962-3777	La Grande, OR

## APPENDIX 1-2

### INTERVIEW NOTES

#### **Interview with Jim Ruzycki, EOU**

**March 10, 2004**

Q: As a user of the John Day RME database, what goals do you expect the system to satisfy, e.g., record monitoring events?

- ☐ Report data, e.g., estimation of annual fish survival rates, smolts to adult return (SRA); abundance estimates of fish by life stages and locations.
- ☐ Interface with basin wide database for electronic tags.
- ☐ Present data as points in a GIS layer to report fish distribution across a landscape.
- ☐ Schedule of monitoring events.
- ☐ Develop sampling designs, especially using the geographic data.

Q: What might be your access requirements for the database?

- ☐ Server-based system seems most reasonable.
- ☐ Web-based may be possible but would need to think about best location.
- ☐ Data calls are common and frequent and web-based access for data calls would be useful. Now post data to ftp site.
- ☐ Two teams will want to enter data simultaneously.
- ☐ MS Access (Queries), Excel type of functions and user interface.

Q: Can you name groups of users who might also want access? Would their reasons for access differ? If so, how?

- ☐ Other agencies and consulting firms may find read-only access useful. They use data as part of a larger context, e.g., basin-wide.

Q: Beyond the monitoring protocol data, what other kinds of related information do you anticipate requiring?

- ☐ Determine method of collection of monitoring data.

**Interview with Tim Unterwegner, ODFW**

**February 25, 2004**

Q: As a user of the John Day RME database, what goals do you expect the system to satisfy, e.g., record monitoring events?

- ☐ Determine habitat recovery rates.
  - We now use the Photopoints application to illustrate change over time.
- ☐ Fish management goals:
  - Identify trends in abundance and habitat conditions.
  - Identify and schedule the monitoring teams for data collection.
  - Extract data to develop presentations for interested groups, e.g., Soil Conservation groups, etc.
- ☐ Record data for special projects:
  - Special projects usually done every year, e.g., density of juvenile steelhead
  - Could use existing habitat data to develop a new sampling design, e.g., locate every tenth pool to collect samples.
- ☐ Avoid duplication of effort where other agencies are doing the same or similar monitoring.

Q: What might be your access requirements for the database?

- ☐ Web-based is preferred.
- ☐ Data security:
  - Identify data ownership and limit update authority.
  - Past data can be updated when technology changes requiring the ability to update prior data.
  - Approval for update may be desirable for some data fields.
- ☐ Allow export of data to other applications, e.g. MS Excel.
- ☐ Allow import of data from standard applications, e.g. MS Excel.

Q: Can you name groups of users who might also want access? Would their reasons for access differ? If so, how?

- ☐ Data requests occur weekly from State and Federal agencies and other interested parties. Reasons for access differ depending on how the data will be used.

- ❑ A central repository for data calls would be desirable. Requests could be referred to a central source to extract data.

Q: Beyond the monitoring protocol data, what other kinds of related information do you anticipate requiring?

- ❑ Documenting special project information, such as research question, etc.
- ❑ Documenting unanticipated data that is found during field monitoring. For example, in 1990s ODFW was monitoring the density of west slope cutthroat trout. Monitors were also catching rainbow trout, which they recorded. This data later proved very useful.

APPENDIX 1-3

RME GROUP MEETING NOTES

October 16, 2003

March 30, 2004

April 14, 2004

Bureau of Reclamation John Day Pilot RME Project – Kickoff Meeting  
October 16, 2003

Vision of the John Day Pilot Program

Overview of John Day and Wenatchee Programs – M. Newsom

FCRSP BiOp in Dec 2000 has RPA that deals with RME.

Status monitoring program, effectiveness monitoring program, data mgmt program

And perform analysis

Landscape analysis – satellite imagery collection

Can fish status monitoring be done at that scale?

Population Monitoring – evaluate status of fish populations in the eight ESUs

Project their effect on improving the populations

Inventory projects and track history and implementation status and result.

RME group conclusions:

- Not enough data to support conclusions.
- Programmatic approach to monitoring.
  - Categorize projects to enable tracking of result and impact on fish.
- Associate a database with the monitoring activities to support tracking and data management.

Database Development Projects

- Large top down approach too expensive based on Oregon Coho system.
- Chose pilot projects as a strategy. – John Day, Upper Salmon and Wenatchee
- Last two years spent developing guidelines that are now being reviewed by scientific entities – Independent Science, et al.
- Status monitoring will start next year – spring 2004.
- Effectiveness monitoring also starts next year.
- Watersheds studies with both status and effectiveness monitoring to be done – now in formative stages. Goal: tease out impact of restoration projects. Many questions yet to answer. On John Day, beginning with river basins. Would also like to use sub-watersheds.
  - Not a new approach – may use similar projects as a model.
  - Very complex.
- Workgroups: Analytical, protocol and fish collection (measurement / habitat sampling) will define data collection methodology.
- Protocol group is defining specific protocols in the pilot basins.
- Due date for workgroup plans is mid-December.
- Answer the questions: What are the data collection needs of the John Day?

Bureau of Reclamation John Day Pilot RME Project – Kickoff Meeting  
October 16, 2003

- Data management will move in parallel with programmatic pieces
- Glue that holds basin projects together

Vision: Chris Jorden

- This project acts as a first step in NW salmon management for tools for monitoring and assessment of salmon recovery projects.
- Goal: Data in and out without loss of quality or efficiency.
- Common data is defined to support large-scale assessment.
- Work with groups that are establishing protocols to define a data dictionary.
- Get large, landscape scale attributes – mostly GIS that will form the context for management and assessment.
- As protocols are established then lower level data can be collected.

Project Background – Stuart

Report from SAIC available online via NWPPC website

700M \$ of projects for salmon recovery.

Success for NOAA would be if John Day and Upper Columbia had the same set of protocols and data requirements.

In addition data defined for project information tracking: objective of project, owner, size and scale, etc. NOAA is working on this project level reporting system. NOAA would like to use the same project level data reporting information.

Discussion of John Day Pilot Project Goals:

- Go to areas: Present monitoring protocols developed for CO. Basin, see what matches in the John Day and develop data dictionary.
- Data Need: Metadata, custody, quality of data, crosswalk to different systems (access / reporting requirements).
- Conceptual model discussion: May not be required.
- An inventory of Oregon data Jim Resigi.
- Scientific questions will be defined by ?

Bureau of Reclamation John Day Pilot RME Project – Kickoff Meeting  
October 16, 2003

- What happens to our deliverables? Who owns the result?

In scope:	Out of Scope
Build data dictionary for minimum set of variables as defined by Monitoring Strategy for the Upper Columbia Basin.	Define new methodology and list of variables.
Using the provided set of contacts, document the John Day legacy variables and collection methods that vary from Monitoring Strategy.	
Document legacy data that exists.	

Vision: Develop a model of the data framework that supports the implementation of the Monitoring Strategy in the John Day to serve as a model for eventual implementation in the entire Columbia River Basin.

Define Data Input mechanisms – field forms, etc.

Define Data Output mechanisms – access, CRUD, Business Rules for access.

Define People who have data: Local utilities, State agencies,

Proposed Structure for Meetings in John Day:

- Present RME questions
- Present RME data structures
- Perform Gap Analysis

Alternate Proposal – Have joint WA and OR RTT groups meet together.  
Working group in OR is not comprehensive.

Develop list of stakeholders using Rick Barnes list as a beginning.

Objective is to support the RME program.

Conclusions:

- Monitoring team will develop list of contacts and contact Barnes to complete
- For each contact, take RTT document to them and identify gaps.
- Develop inventory of data sources.
- Reconcile analytical document with data inventory.

**John Day Basin Research Monitoring and Evaluation Pilot Project**  
**Monitoring Data Dictionary Review**  
**Portland, Oregon**  
**March 30, 2004**

Meeting Attendees:

Mike Beaty, USBR  
Lanie Paquin Boler, USBR  
Michael Newsom, USBR  
Richard Kang, NWFSC/ NOAA  
Stewart Toshach, NWFSC/ NOAA  
Carol Volk, NMFS-NOAA  
Cedric Cooney, ODFW/StreamNet  
Jon Bowers, ODFW  
Tim Unterwegner, ODFW  
Roy Beaty, BPA  
Eric Lowrance, BPA  
Julie Conley, Monument SWCD  
Rick Barnes, Barnes & Associates  
Russ Faux, Watershed Sciences  
Tracy Hillman, Bio Analysts  
Kim Johnson, Spatial Dynamics  
Shane Hopkins, Spatial Dynamics  
Michele Tae, commonthread  
Lane Schulz, commonthread

Meeting Objectives   Mike Beaty

Mike Beaty introduced and reviewed this meeting's desired outcome: a shared understanding of the John Day RME Data Management Pilot Project, with a focus on its Data Dictionary (database entity list). His PowerPoint presentation covered the background and goals of the Pilot Project. He explained the Empirical Method Road Map, a conceptual framework for geospatial information to coordinate research efforts in the John Day that demonstrates how the work will be organized. Mike covered the role of the Data Dictionary. The idea is to build a geodatabase container for all the data that is available. The Data Dictionary will also provide the ability to support fieldwork.

The Data Management Team, a design team, will consist of the three entities—Bureau of Reclamation, NOAA Fisheries, and the other Action Agencies. The focus of today's meeting is on the data that is to be collected. The end product will be a common Data Dictionary. Notes of the meeting are being taken for the purpose of recording participant questions and comments rather than as a complete record of the presentations.

*Contact List*

Kim reviewed the Contact List used by the project team. This includes:

Habitat: Rick Logan, Don Butcher, Shannon Huebner, Kim Jones

Aquatics: Hiram Lee, Jim Ruzyki, (Tim Unterwegner should not be listed in Aquatics group)

Other: Tracy Hillman, Michael Ward, Russ Faux

*John Day RME Information System Vision*

Michele Tae presented a high-level chart of the John Day RME Information System Vision to help identify the scope of the system.

Discussion and questions:

- Q: Can you sort the contacts by this grouping?  
A: Yes.
- Q: Is there linkage with other databases, e.g., StreamNet.  
A: We can provide data to other systems but we would not store information for them.
- It was suggested to add another circle with a double-headed arrow called “Other Data Systems”. We will probably have to take a physical download from other systems and load it into our working database. Issues of access to other peoples’ systems and databases gets very complicated – there is an issue of how are they serving up their data and how it can be manipulated to meet our specific needs.
- Q: Given this conceptual framework, as part of an assessment, would other systems such as StreamNet have been overlaid to meet John Day’s requirements? How have you assessed what these systems can provide to help in getting this John Day information?  
A: The needs were identified through the interview process.
- Q: Where should the researcher or monitor send the data, and in what form? I’m looking for “this is the one place to send your stuff and they will provide the metadata requirements, etc.”  
A: The monitors should submit their data to ODFW and ODEQ; we would take the data from them. At present some of it is not being submitted to those databases so is not available to us. Our preference is that it should all be checked into ODFW and we can map from that.
- Q: This sounds like a scoping issue. It appears that you are setting up a format and hopefully a database like StreamNet would adopt your protocols. Is that right?  
A: That’s as far as we have come. We have just really begun to touch on access issues.
- Team: This pilot effort is driven by the monitoring strategy that Tracy Hillman developed. It is for supporting data collection under the current RME programs, to give those in the field guidelines for what they need to collect. We are not trying to normalize data, just look at it as it comes in from ongoing field activities.
- Understanding that focus is on present and future monitoring efforts, within ODFW there is no discussion of what standards should be; they have not sought to involve other projects. ODFW has a larger mandate than just the monitoring efforts that are taking place in different places. We are funded by StreamNet. Might be on shaky ground relying on that system because it really doesn’t exist yet.

- This is a pilot study. The purpose is to build a data structure from the ground up. First you figure out the questions, then the analysis tools, and then the data needed to fill the analysis. Tracy Hillman's protocol document was the start, now we are trying to build the data dictionary to meet those needs. We received feedback that people have a lot of data but often can't use it. We want to create the analytical framework so that we will be able to use as much existing data as possible.
- The intent of the Hillman report was to develop a comprehensive monitoring strategy that is acceptable to the Action Agencies, NOAA Fisheries and RME and actually implement it. It talks about various designs, and a framework for addressing the plan. Deals with all the levels of monitoring including landscape classification, all the GIS requirements. Step by step it puts together a monitoring program that one can follow to design a statistically robust program. The data management you are doing is going to be a crucial piece. Most recent draft of Hillman is February 1, 2004. Relies heavily on EMAP sampling design.

#### *John Day Basin Pilot Study*

Kim Johnson reviewed the chart that shows the levels of effort expended in different areas of this project's Phase I.

#### Data Dictionary Presentation and Exploration

Kim Johnson and Shane Hopkins

Kim reviewed the *Strategy Protocol References* which relates the data to the references. It is divided into the three major groups: Biological, Habitat/Physical, and Classification. Most classification features will show up as spatial datasets in the final document. The Data Dictionary currently contains 900 entries.

- Q: Tracy Hillman was asked what overlap exists between this and PNAMP (Pacific Northwest Aquatic Monitoring Partnership).  
A: PNAMP is using these to develop their indicator list. But they think there are probably more indicators here than are needed. This is contrary to when we first asked the question. Then most people were thinking of indicators to add. Now they are going in the other direction. This is pretty much the core set of indicators.
- Q: Is there a plan to have people look at the full scope? And to do a cross check with StreamNet for conformity?  
A: Cross correlations with StreamNet would be very good, to see how this bottom-up driven project compares with what people are currently doing.
- Kim spoke about the discussion of protocols. People in Habitat felt that both sets of data could be collected, as long as someone paid for it.
- Q: A manager will say, "We spent money here, did it work?" There needs to be something consistent throughout the sub-basin efforts to see if they worked. For each sub-basin we will need to collect something consistent so we can figure the final product. Can that data actually be collected by everyone doing this, or is it pie in the sky? Ranking would help.  
A: We haven't looked at that. It is beyond our scope. That's probably a good approach to take.

- Team: From the business requirement standpoint it would be helpful to know the implied use of the data or what sort of evaluation might be conducted to see if we are getting the most for the money.
- Team: At the December meeting they went through this habitat list, and didn't seem to have any big red flags that this could not be collected. So this was addressed and the group believed it to be feasible.
- Team: Our strategy has been to focus on the organizations that are presently active and ready and willing to provide us with data. There is also a host of outliers who collect data but don't seem to readily share it with anyone. We have not concerned ourselves with them at this point because it is not productive. We hope to attract the data by providing the standards, and get past the objections that there is no place to send the data. Once we have the available data the others will follow. We expect that the funders will pressure people to send the monitoring data in.

Kim asked the group for their comments on redundancy of indicators, etc.

- We need to think of this as a complete database. It needs to include and be able to expand to address additional indicators. Ask how many additional indicators should be included.
- Q: Tracy was asked if he takes exception to ISRB's (Independent Science Review Board) standards.  
A: ISRB was more addressing effectiveness, so we are talking about two different things. The database should include all the data collected in the field, regardless. It should have the flexibility to handle a whole host of other indicators.
- The notion of not throwing the indicators out was endorsed by other meeting participants. That is the meaning of a dictionary—it should include all the data that one could or might use.
- This will show how it is done if you do choose to use a certain indicator. Why or whether we would use a specific one is outside of our purview.

### *Sample Protocols*

Kim covered the sample protocols, and Shane demonstrated in the actual database spreadsheets on the projected screen.

- Q: What would be entered into the database, for example, the maximum temperature rather than all of the raw data?  
A: No, the raw data is at the bottom of the page.
- Issue: Will the data dictionary have only the more useable derived information or will we store the raw data itself? It is a humongous load, and not necessarily useful. Our initial take is only to keep the derived.  
The group was asked for their thoughts:
- Research feedback is that the raw data needs to be accessible as well as the derived data.
- It is important to be able to access the raw data, maybe by slipping through a portal somehow.
- Each sub basin could have its own raw data file that is then somehow connected to the central database. We could go to the sub basin for the raw data, have a linked path between the two systems.
- I think we should throw out quality assurance/quality control. What is the raw data?
- Q: Are you handling historical data?

A: At this stage we are just saying we know historical data is out there but we aren't going there.

- That is what Carol Volk is working on for John Day -- collecting the historical data and figuring out what kind of (perhaps one-time) database would address all of that.

- Q: What about location, lat/long?

A: We have a definition for the sample site that includes all of that. We have pretty much followed the EMAP data standards. Generally in the past we have supported two concepts:

- A macro plot, where all the sampling is clustered around.
- Sub-samples clustered around that -- associated with macro plot but defined by GIS standards.

We want to avoid having lots of data come back in different parameters, etc.

- Team: We will take an object-oriented approach to the database design. The high-level sample site will have a point or polygon associated with it. Then the attributes of that site will be specifically what was collected there.

- Q: Will all the sites tie into a Hydro model?

A: I think they call it a hydro point in ARC Hydro.

- Q: In terms of a standard, there are several different Hydro models, have you addressed that yet?

A: No we haven't gotten that far yet. We are working on this as part of the geospatial infrastructure. We don't have a solution yet.

- Q: Can you put in a lat/long and maybe a radius, and ask for the diameter for that site? I'm trying to get a feeling for the structure, the level above it and how it is accessed; the mechanism for drilling down, if the spatial scale is different from a fish standpoint than another standpoint might be.

A: You could select from the metadata which ones you would want to use.

- Q: Could you search for all the data for the South Fork, by temperature, for example?

A: Both -- by particular reach or by all the temperature data.

- The beauty of it is the way the archival data model stores data. You can slice across axes any way you want. The database allows you to query from any dimension you want.
- I want to be able to look up data with the same classifications and look up what worked. We need a "Management Actions" characteristic to see what the response of the indicator is to a certain management action, to identify what action was implemented and identify the response. Second, we may want information based on each transect in the database.
- Want to be able to break out information by each of the 11 or 20 transects, so suggest keeping the data split up as best as possible.
- Regarding rolling the data up to get project level accountability: Are we digging down to see the correlation between the action and the fish?
- We want to, at some level, be able to relate the sample site and the project (the project could have a number or a name).
- We need the link across. It could be a spatial/temporal type of link.
- Team: In an ideal world we would have the latter. But what we will probably have to do is some sort of spatial link.
- But since the monitoring sites aren't unique you need something other than location to sort projects. Need more than spatial/temporal.

- Yes, the RME database must acknowledge somewhere that those links need to be made.
- Team: Spatial/temporal data is a basis for linking to RME data. Because it is something you don't have to take, but can just have the ability to do it in the future.
- Q: We need to know the method: the attribute of "Name of Method" isn't here.  
A: You will, but that will go back to the specific references.
- If you change methods then the database attributes will probably also change. Lanie explained about specific gateways.
- Team: We will do an ad hoc exploration of the database after lunch.
- Q: Are we are talking about a method of counting redds or the different kinds of redds?  
Aerial counts versus foot counts.  
A: The database will be a repository for the data. There will be information telling the protocol of how the data was collected. It won't contain all the methodology; that will be in a handbook elsewhere.
- Purpose is to get some agreement on how we are going to collect the data. We may not in fact put data in here of redds that are collected by aerial surveys if we don't agree that is how we want to collect data in this program. Or, if thermal data doesn't fit into the analytical framework and we are not going to use it, it may not go into the database. We will need to decide the scope of what is in, what is not.
- We need to deal with this issue, be clear that there is a data world and this is a subset of it.
- Q: There will be a lot of data out there that won't fall into these protocols. Do we want it or not?  
A: We are going to address how people can make use of the data dictionary for the on-the-ground work.
- Concerned about the issue of implementation. At some point we need to talk about tools. Our field people don't have time to do this unless we make it easy for them.
- Q: Will you track the hours involved in tracking this data? It will be driven by the budget.  
A: That is an interesting meta issue, and we haven't contemplated it yet. The funding agency will have to decide usefulness and efficiency. Carol Volk is involved with this.
- At a data definition level you can have a definition called "times and effort of sampling" or something similar.
- Team: By tying it to protocol and trying to keep it simple the extra cost is actually pretty minimal. We want to avoid someone having to fill out a lot of different data sheets. Following a certain protocol will keep the data collection from being onerous.
- If someone decides they will follow your protocol they will have already looked at the cost to them.
- Q: To make this really useful we need to have the data even if it does not meet the protocol. Could it be flagged in some way if it doesn't meet protocols?  
A: This is a scope issue.
- Michael Newsom pointed out that one of the reasons we are doing this approach is that we discovered that the data we have been collecting is insufficient for the research analysis we want to do -- to collect a database we can use for the analysis efforts. The Oregon EMAP program has an extensive set of field forms that they use, which we need to be sure we have looked at. The goal here is to put together a database that will work for programmatic monitoring that will be sufficient for the analysis and, to the extent we can, to capture the historical data.

- We still don't have all the tier-one, -two and -three pieces put together, so there are a lot of things that will affect the cost.

## Lunch Break

### Review of Characteristics and Indicators

Michele Tae

Michele broke the group into small teams to review the remaining data dictionary protocols/characteristics. The teams were instructed to review what had not been gone over in the morning for content, including identifying what is missing. She invited all meeting participants to give these in writing to the Spatial Dynamics team as well.

- Michael Newsom pointed out that at least three and maybe four projects are starting in the John Day this summer. A fish monitoring, a FLIR analysis, a Landsat analysis and a TMDL project. He would like to make sure that this summer their data dictionary is sufficient to run those projects, and would like to use this data dictionary as the reference. He asked this group to keep this project on track in order to help these new projects.

### Comments:

- Q: There is quite a bit of redundancy from one domain to another. Do you have to type in your response for valley confinement, for example, or does it auto-populate?  
A: There hasn't been an attempt yet to normalize that but we intend to do that.
- Under drainage density/domain drainage basin, use metric units as much as possible though must have both units available. Assumes database will automatically make conversions.
- You should use a non-metric unit for a non-metric variable.
- For each variable it would be nice to have the site the attribute is in—one entry could talk about the site location, and then write out the attributes, etc.
- If I'm interested in stream flow I want to know what location it is in.
- Q: What actually gets input at the data dictionary level versus a site index level?  
A: The site level will have location as well as verification information, and coordinates and some sort of GIS information. With EMAP they want assurance you are at the right site so they ask for some sort of confirmation.
- Q: The domain... is there a general glossary?  
A: Kim gave the definition of the domain.
- Q: On Stream Flow, it looks like there are several types that are collected, but on the first one "distance from bank" was only used for one of the first three different measurements for stream flow. Be consistent across the three parallel sorts of measurements as far as what you are collecting.  
A: The technique used is a function of the protocol.
- There were some general comments regarding site location.
- The site location data was not included in this sample. Kim reviewed it.

- It is important to have the locations of the upstream and downstream locations. If your only coordinate is at the x site you'll have a different location for your top and bottom. So you should document/monument the top and the bottom, at a minimum. The protocol calls for doing that with GPS, aerial, and rebar and metal detector, too. Most people don't care if you hammer in a piece of rebar. Sometimes GPS just won't be able to do it, in a canyon for example.
- We are starting to get locations and now we specify to one decimal point, but we haven't looked at what level of precision we need to require.
- Team: You should look at what precision you really need.
- You want to be as precise as possible. It can significantly change things. Within 3-4 meters isn't close enough for some things.
- Team: The key is to monument it. Unless you use resource grade GPS, which is expensive, you'll only be within a couple of meters.
- 5 decimal points on a decimal degree scale will be used here.
- For temperature, some link to a site map, specific location would be good.
- Question about battery age. And a site map or a description based on what you are sampling.

### Adults

#### Distribution:

- Spawning
- Holding
- Migration

#### Escapement/Number:

- Index vs. extensive or exploratory surveys. (We do a number of different surveys. Some old, for many years, some fewer years, more like 5 years.)
- Survey type - Aerial vs. foot?
- Size – resident or fluvial?
- Hatchery vs. wild

#### Age Structure:

- Collection method – fishery or weir, carcasses?

#### Sex Ratio:

- Wild or hatchery
- Mature or fresh run fish

#### Origin:

- What kind of fin mark? There are other fin marks besides Ad.
- Is it PIT tagged?

#### Fecundity:

- Fish size / age
- Hatchery or wild

### Redds

#### Distribution:

- GPS location / finer scale resolution. Redd distribution depends on how fine a scale you want. We define a beginning and end point of the survey but also identify... for each redd.)
- Number of collection sites: why needed? When we do a reach, it's typically only one reach.

- Index vs. extensive vs. exploratory
- Wild versus hatchery
- Aerial versus foot

Number of Redds:

- Use size of redd, especially for bull trout. Fluvial / res.

Juveniles

Abundance:

- Size or life stage.

Size:

- List whether we are talking about 1+'s or 0's.

Smolts

Number:

- Wild vs. hatchery
- The reference to trap location should probably be number of days fished. In John Day flow was so high this winter they couldn't fish for a couple weeks at a time.

Adult size:

- Wild vs. hatchery

Parr size:

- Wild vs. hatchery.

Smolts:

- Wild vs. hatchery
- How do you determine whether or not it's a smolt?

Genetics:

- What method is being used? Mitochondrial or DNA, etc.

Smolts:

- Same.

- Re Adults: Do we need distribution for adults?
- Appropriate domain would be the subbasin.
- Difference between spawning, adult holding and migration in terms of distribution.
- PIT tag. (Unique fish identification)
- Temperature: OWEB - Oregon plan or technical guidebook specifies a post-sampling calibration, but there was only a pre- not a post-. This is not in the Zaroban procedure.
- Watershed Condition: It was observed that we are missing upland vegetation (land use/land cover).
- Identified a clarification for gradient for stream reach. Under "Begin and End Reach" it didn't specify whether you are looking up stream or down stream. Make sure that is clear.
- In general the tier one needs (landscape level) need to be better represented in either the data dictionary or the database design. So far the focus has been on tiers three and two, tier one level data hasn't been adequately addressed.
- Channel Characteristics/Elevation: In the elevation field itself you ask for the elevation from a quad map at the start of the survey, why not get the elevation throughout the entire survey?
- How do you derive slope with only one elevation point?
- Sinuosity: no mention of the calibration approach to measure that.
- Date field only allows one field though it mentions "dates."

- Bed form type: is bedrock a valid type, or is it a substrate type? Define it more clearly.
- Valley form type itself: You say it is for stream reach but which one is for the entire drainage versus the survey reach you are in?
- What is the value of pool reach?
- Typical Confinement /Slope: these are subjective; it doesn't spell out what you are looking for.
- Stream Length: It doesn't specify how to measure or calibrate it.
- Channel Gradient: Do you really want both map and measure in field? Explain to the field samplers that this is what the protocol calls for.
- Gradient... have the system calculate for you. It would be different for a crew doing it every 200 meters than for a crew doing it every 300 meters. What if the survey length is less than 200 meters?
- Riparian Vegetation: you have a field type of "imagery type" but then date as "date over which sampling took place"—does this mean dates when photos are taken?
- Under Fish: Sub-run/Upriver Brights/ Type A: We want to be able to distinguish those.
- Confidence levels? Survey length?
- Adult Age: You are not asking for sample size? Not sure why you are asking for spawning escapement for individual survey area.
- Weir location /Weir ID: Scale samples can be obtained other ways than in weirs, so this would be limiting.
- Sex Ratio: same thing on data collection method. It is not clear whether the sex ratio is for the sample or the stream or for the overall population.
- How are Collection Site IDs different from Stream ID? How would one differentiate them?
- For Time of Collection, you would want the actual time, not day or night.
- List of attributes and descriptions: it was suggested to use Description/Definition. The definition should be a definition of the attribute. The attributes must be unique.
- Acronyms need to be put into a glossary so the document can stand alone.
- Some inconsistencies exist in the language:
  - Site ID and site number: do they mean the same thing, or two different things?
  - For accuracy, use four-digit years.
- Reference in Description to unique site IDs: You may have a unique site ID within the project, but do you want to have unique site ids across a project? Need a standard way to come up with a number for a new site.
- Scale as a data type: explain all the different data types.
- What will the standard be called when the change process begins? Why was a certain protocol meaningful before, now a new one is?
- We need to know if this is basic data or derived data.
- Need to know also whether this set of tables is base tables or lookup tables. Need to know which are the primary base tables.
- Also it needs to be clear whether this is GIS data even though it can be captured tabularly. Need to know that there are multiple applications of the data. In general, redundancy isn't bad.
- There are actual documents as well that are data.

- In framing this dimension you try to do that by indicator group, but we were talking about base high-level components that repeat for any organization:
  - Organization tables
  - Money
  - Resource (the actual biological resource: the vegetation layer, soil layer, etc.).

### Identify Additional Contacts

Michele Tae

Michele asked, as part of the short-term strategy, to know anyone we have missed who is really pertinent to the John Day. Who else should this team contact? And would the additional information extend the scope or add to the Data Dictionary characteristics and identifiers?

- Biological people
- Data people
- Cedric Cooney suggested himself. He would send his data manager or biologists from his department.
- The test would be to ask if what they need is already in here. Later you could be picky about what word you use.
- Team: We don't want this to be too open-ended; this wouldn't necessarily serve our immediate need and purpose.
- Suggestions were made to include:
  1. The Tribes
  2. The Nature Conservancy
  3. Cedric suggested John Rogers should be involved.
  4. TMDL: We already have talked to Butcher.
- We have each of the four types represented in our contact list.
- We don't have the Landsat requirements yet. But it will show up as a subset of the spatial data.
- Contact Steve Waste at the NW Power Council.

### Issue Bin

Michele Tae

- ⇒ Data Quality Assurance /Quality Control
- ⇒ Raw Data vs. Derived
- ⇒ Core Set vs. Expanded Set (EMAP/TMDL/Landsat/FLIR)
  - Protocols: Mandatory/Optional
  - Build in checks
  - Validate
  - Based on Method?
  - Systematic DQ ranking
- ⇒ Links to Other Data – e.g. Project Database
- ⇒ Historical Data – how to address?
- ⇒ Tools

- Forms, etc.
- Process
  - Reporting
  - Collecting

Discussion:

- Regarding Tools: “Process” needs to be in there. In between the field form and database there is a huge gap. Divide Process between reporting and collecting the data; there is a distinction.
- Team: From a reporting standpoint we need to be sure the data are granular enough.
- Core assumption: Protocols that will be used for this summer’s field season will be based on the Columbia Basin Monitoring Strategy and the associated methodology.
- What about the assumption that people actually calibrate their instruments?
- Team: This boils down to workmanship and it is outside of our scope.
- From a data manager standpoint it is your job to be sure of the quality of your data, to take responsibility for that. What you find needs to get fed back to the field manager so things can be changed.
- To come up with a qualitative assessment of the data, you need to give it some kind of a rank according to how it was checked, a systematic way to give it a relative value.
- The loop of responsibility starts with the clients who have to make sense out of the data, and that’s the scientists. For example they can work with the field forms and give a range that is acceptable/likely. This could be built into post-entry data checking. This is not a trivial exercise; it may be the toughest piece.
- *There was a drawing on the White Board of the:*  
 Scientist Data Quality Responsibility Loop:
  - Data collector is responsible for calibration
  - Data manager is responsible for validation and exception.
- The instrumentation piece: if those fields aren’t filled out then it puts the data in question.
- Team: We are not in a position to challenge the data.
- It is the scientists who have looked at the data who can tell what range they need.

Core Set vs. Expanded Set Discussion:

- Define the Core Set as mandatory or optional. If you’re going to collect the data there is a minimum level you have to collect to make it meaningful. Minimum business rules must be captured.
- Team: We aren’t trying to tell the field managers what we need to have data on. We need to be told what is optional or mandatory.
- We have to try to get our contractors to be involved in something like this. (Rick Barnes explained the three different levels of communicating this all to them. He will write out this info for the team.)
- We have to assume we are working with an Expanded Set.
- Team: We have taken the approach of asking what protocols are you actually using. We are not arbitrating among protocols; that is someone else’s decision. This data dictionary incorporates all of the protocols. So the Expanded Set will be the Core Set.

- The protocol manager manages your protocol attributes so you can add or change attributes to a protocol. It does assume you are collecting and recording your data by protocol. It supports a variance on protocols.
- Unique terms may or may not change the protocol. Where you have a column for the original name for the protocol, there should be a column for the term we are using in the database design for this particular term. That would deal with this issue.
- Another layer of expanding the Core Set of both attributes and protocols is asking the field staff what they normally collect and want to collect for their own purposes when they are out in the field.
- While we want to be open, we have to draw a line and say this is what we can do within the limits of our project. You (team) must not get out of scope trying to please everyone.

#### Links to Data Set:

- This issue seems like something the team needs to sit down with and talk about.

#### Out of Scope:

- Historical Data is out of scope of our current effort.
- We are working on the issue of historical data; it's on our plate, it just isn't addressed by this particular effort.
- Can it at least be inventoried?
- Our strategy is that as we identify all the available indicators, we will attempt to look at the historical data and park them into that same set of indicators. What is the purpose of having historical data if you can't do a longitudinal study by indicator?
- Other Domains are also out of scope.

#### Future Steps

Mike Beaty

- We talked about the geodatabase design.
- We are using the contractors here, NOAA Fisheries and BPS to develop a geodatabase design.

#### Status of Other Related Efforts

- Stewart Toshach offered a brief update on CIPCIS, which is for better data sharing and exchange. The acronym was recently changed to NED: Northwest Environmental Data Network. Stewart said there is a need for an approach at the regional level for collecting, managing and sharing data that is more than an ad hoc effort. The willingness of all to enter into an agreement is currently being tested in a 9-month exploration phase. Couldn't CIPCIS adopt the standards and protocols that this group is developing?

#### Wrap Up

- The notes of this meeting will be published for everyone.

- Our timeline is we are shooting to have the Access database proposed Data Dictionary with the final report by April 30, 2004. The report will be a wrap-up of what we have gone through and what we think our next steps are.

Acronyms:

PNAMP: Pacific Northwest Aquatic Monitoring Partnership

ISRB/ISRP: Independent Science Review Board/Panel

Additional participant notes handed in at the end of the day:

Water Quality Temperature

Fields for entering

Field checks-

Checking monitors against NIST thermometers in the field

Levels of Monitoring/Data Collection Implementation

1. Voluntary: If you are collecting data on these attributes then please use the prescribed protocols and submit your data to the pilot database.
2. Prescriptive: If you are monitoring these attributes (w/"our" funds), then use the prescribed protocols and submit your data to the pilot database. Data quality standards may also be prescribed.
3. Mandatory: If you are monitoring habitat or fish population data with "our" funds, then you will monitor this (specified) set of attributes using these protocols and submit your data to the pilot database.

**JD RME Data Dictionary Pilot Project Meeting  
April 14, 2004 in Boise ID**

Attendees: Mike Beaty, Lanie Paquin Boler, Kim Johnson, Shane Hopkins, Lisa Myers, Michele Tae, Lane Schulz

Today's Meeting Outcomes      Michele Tae

- 1.) Preparation for Friday's Wenatchee meeting
- 2.) Ensure that expectations are clear for the document we are producing that contains our findings.
- 3.) Review Table of Contents

Review of Spreadsheet: Temperature Protocol for Smolts      Kim Johnson

- Some changes:
  - Site ID will be added, and Data Collector as well as Reviewer.
  - Subbasin attributes will stay in for now, mostly for the comfort level factor.
  - We dropped some of the redundancy, per Tim Unterwegner's comments.
  - Genetic Method was added to Genetics (Do we need to do sex there?). Origin. Sex.
  - Issue: Genetically you can't tell the difference between hatchery and wild fish.
  - Add Program ID? To tie in with the Program Project ID, an external link.
- Michele asked if some of that metadata is across all the protocols? This hasn't been established yet. Kim did not interpret that Stewart wants that yet, he just wanted a DD.
- Kang's feedback at the March 30 meeting reflected his desire to try to avoid some issues that had recently arisen in his latest project.
- Kim doesn't want to go too far on the geo-modeling of the sampling data until the database is done.
- Mike: What Stewart originally asked for is highly contingent upon processes and consensus within the scientific community that are out of our control. We can try to do something that will more or less suit our design.
- Michele asked who will do that work and when?
- Mike: It is part of the pilot and the prototype. We will try to use you all and Kang and Eric Lowrence to develop a DB design we can then all start to use as the container so we will have a working prototype. In the design process we will winnow thorough all the conceptual stuff, then move on to physical design of the DB.
- Michele: Do you hope to flush out the requirements more fully in the design phase?
- Mike: We know we have a potentially limitless set of user requirements. What I'd like is to do the prototype and DB design using the use cases, and the ones we come up with intrinsically. We don't have time to do more than the more simple uses. For example, the ability to put data in, take it out, etc.
- Michele: We need to document the assumptions as we go along. Mike: Right. Explain that these are the use cases, etc., we are working with.
- Mike: Our refuge is we are only developing a prototype. We don't have to have everything.
- Kim: Some of us are sure that the GDB design will work to track the salmon change/recovery for the West Coast. But lots of people aren't ready to cross to GIS for managing tabular data, and to understand that it is more than a GIS caboose. We still have to convince people we can haul these cars with our engine when we're done.
- Kim talked about FLIR, and handling the requirements Michael Newsom put out there...

Friday's Wenatchee meeting      Mike Beaty

- Mike and Lanie, with Shane and Michele, will travel to Wenatchee on Friday to work with the RTT (Regional Tech Team) there. At Chris Jordan's behest, they will use the Wenatchee RTT as a focus group for a beta review of the DD in its current state. Their plan is to take the DD as is, and have Mike Ward be the focal point for a review process of the DD by the Wenatchee group. The

comments will be collected and used to help refine the final product that we have been looking at delivering on April 30<sup>th</sup>.

- Mike: In exchange for creating a preliminary version to present in Wenatchee, this team can take the latitude of a couple of weeks at the other end to produce the final document.
- Michele asked what are we looking for from the Wenatchee reviewers?
- Mike: We want to avoid having them walk through every single detail. The meeting time is short; they will go what we have given them after the meeting itself.
- Michele suggested giving them the summary sheet only, not the detail, since they will comment on details if they are given them. She suggested getting them to commit to the process they will use to get their comments back to us.
- There are 14 people on the tech team who will be at the meeting, and Mike Ward is expecting maybe another six people.
- Mike B. asked Mike Ward to be the focuser. We will receive the comments from the team through Mike Ward only, by a certain date. Mike Ward understood and agreed to play that role.
- Date by which Mike Ward will get the comments back to us:
- Mike B. initially offered Mike Ward the idea of a week or 10 days. Kim thinks a week is more than enough, and that we should try for three working days. We should explain we would like to include their input in the final product, and that they will have another opportunity to revisit this.

#### *Trip logistics*

- The logistics were covered for the trip to Wenatchee this Friday, April 17.
- Mike will double-check the schedule and will send out the details by email tomorrow.
- Michele, Shane, Lanie and Mike will make the trip.
- Be at Western Aircraft Terminal by 7:15am for a 7:30 flight.
- Depart Wenatchee around 2:30pm.
- Estimated return to Boise is 6:15pm.
- Aeronca Rd. is the first obvious road to the left after the runways. At the big gravel parking on right, go to your left, out by the tarmac. Not the big gold building. Immediately to left, "Terminal" with blue awning.

#### *Products for Friday's Meeting*

It was decided to give the RTT spreadsheets vs. the database report, which saves paper, and the structure isn't meaningful to them. It is easier to see it in spreadsheets. Hardcopy was chosen over an electronic version, partly because there is only one working day before the meeting.

#### *4 Questions for Friday's meeting:*

- 1) Is anything missing from the Data Dictionary that is in Hillman or other reference documents?
- 2) Sampling Design: Are any other sampling types needed to record location data beyond:
  - a. X-site (EMAP) and the 11 transects
  - b. Point
  - c. Transect
  - d. Reach
- 3) What protocols will be used this summer?
- 4) Identify protocol ambiguities. Issues/concerns include:
  - a. Fisheries techniques
  - b. For protocols
  - c. Species and class

#### Further Discussion:

- Kim is still looking for some specific fisheries techniques protocols information; written procedure for Redds and smolts and juveniles. We have found no place where what Tim Unterwegner referred to is actually written down.
- Mike asked about the physical design aspects, the level of detail in the protocols--in other words are there additional details beyond what is prescribed in the protocol that we need to know about, that they would want to resolve ad hoc to make the data useful?
- Michele and Kim felt this is a premature question. There are two camps, one would collect everything, one says limit it to what we can afford to collect. For us, the protocols will be in the database. The question of adding new protocols raises the question of managing the protocols.
- Mike felt it was a question of whether the protocols were adequately prescriptive.
- It was decided to ask the RTT to identify places where there might be interpretation involved, and ask what issues or concerns might exist with the DD as regards the data that could be ambiguously defined?
- \*\*Ask for existing forms.
- Mike: We can tell them if they will use this GDB schema they will have less work to exchange data with others, and someone else who wants to use their work will have an easier time of it.
- Kim agreed that we don't need to reinvent the wheel. The GDB will pull out everything and doesn't need to build it into another database with a bunch of table links. If you put it in this schema, we can pick it up and run with it. This will actually save time on the other end, once the data is collected in a uniform way.
- Michele: So if you know the location, you would know all the ecosystem pieces for that location? I think some people have an expectation that data relationships will lead them to this.
- Kim: That is what the geospatial model does.
- Michele: So the scope of what we are doing is well defined.
- \*\*Kim recommends taking only the habitat and geographic to the Friday meeting so they stay focused on that. We will still provide spreadsheets that have the references and the links to the protocols.
- Michele: Once there is a repository anyone can use it as they wish. Those who are doing monitoring can use the collection of this data to determine change over time.

#### Forms Discussion

- Mike Ward was intrigued by ability to generate forms from the DD. Mike B. asked if we have a means of showing that yet? No, but we can talk about it.
- We are dealing w/multiple agendas on this project. Some users want forms to take into the field. In Wenatchee they are starting sampling now; they would like some forms just to make sure they were collecting the needed data.
- Creating forms would need to be made a separate task.
- Mike: This is the group that focused on the protocols and agreed they would use them.
- Kim: We have the data and the various attributes of the DD but we do not have the forms.
- Lanie asked if they couldn't do that on their side -- generate forms within Access.
- Mike: It was more how the DD could lend itself to that capability.
- Lanie asked if we are giving them enough to work with.
- Kim: Get a list of what parameters they are addressing. We haven't yet put a lot into classification because it will be geospatial.
- Mike felt we should avoid saying we will generate forms for them. They will have different modes of collecting their data, and we should not try to anticipate that. It is more a question of how does what we are producing (the DD itself) lend itself to that need.
- Kim: It wouldn't be easy to create a data entry form from the DD.
- Michele: How much discretion is there in the protocol for users to interpret parts differently, put different data in the same field. The data would be corrupted, we aren't there yet in terms of

collecting the data. But we potentially could punch out a form, it depends on the rigor embodied in that form -- how usable would the data be down the road.

- Kim: We are in the needs analysis and... phase of the typical development cycle, we aren't in the design phase. So we need to be cautious about what people are trying to do during this upcoming field season.
- Michele: if you had a controlled group of people with whom we could work closely, that's one thing. But if they do whatever they want you would need to clean the data.
- Michael Newsom was clear on getting some forms for temperature.
- Mike: One purpose for the meeting in Wenatchee is to sift through some of that and get coordinated. Lanie and I looked forward to the opportunity to work with them because they were the first group of monitors to get their act together according to Hillman's method.
- Michele: It is important to let them know on Friday what we will be looking for, to let them have some more structure.
- Kim: although we are not trying to address everything at this stage, still it is helpful to get all the comments. Would rather ask for more than less, and not squelch them. We are filtering the comments ourselves. Qualify the request by saying we won't necessarily respond to all the comments.
- Kim: Tell the group on Friday we are currently only talking about the protocols addressed in Tracy's document, emphasize that the Hillman document is basically it.
- Question about Origin: It may be different in different places.
- Michele: Are we asking them to limit to the Hillman protocols without change, or are we asking for changes?
- Kim: This is a second order of priority. First, do they see anything we left out of the DD that is in Hillman or other reference documents?
- Mike assumes this was closed long ago, and we won't revisit things we settled six months ago.
- Kim suggested we not have all 20 people at the meeting give comments. We could then focus back on fewer people in the final review.
- Mike B. will have Mike Ward pick two or three reviewers from each area.

#### *Forms for this season:*

- Mike asked what we will have for the John Day monitoring crews to use as a reference or an aid in this season's monitoring work. His concern is that we have something the field crews can work with, regardless of the other design components. Or perhaps they could generate something themselves out of Access.
- Kim said it is possible to generate a report that would look like a form from each protocol. We could offer to do that (this would be more work). There would be advantages from a continuity standpoint, and understanding the relationships that are not necessarily clearly defined in the DD. One form for each protocol might total 80 hours, but not more than that.
- Mike doesn't know that the John Day has that sort of coordination; he doesn't see anybody functioning as the coordinator for that.
- Michele: Pilot forms would provide a way to.... We could provide forms for just the protocols they are actually going to use this summer.
- Kim: ODFW has everything we would want, if they have EMAPs.
- Michele: All they need is the protocol, Hillman and a form.
- Kim: If they would like to change the form, they could give that back to us. We could see how the form works in the field.
- Michele: Or this could be a Phase II item, not for now.
- Mike is glad to hear we are in a position to provide the John Day people with forms if we decide to do that.

- The TOC follows the traditional Business Needs layout. Most of it can be pulled from the up-front documentation of this project, Appendix F. It will also include the process we have gone through.
  - Mike: Appendix F is really the set of business cases we were chartered to address. Then Michele's interviews with Jim Ruzycki, et al, further either ratified or slightly embellished what was in the original plan.
  - Michele: Ideally the people who are actually recording the data have a clean DB to go against. She hears Mike say that the way Appendix F was written there were not any specific....
  - Mike: No, Appendix F was more at the business case level. From that you extract the use cases requirement.
  - Michele will make sure that the uses cases have been extracted, and will create a use case brief.
  - Mike asked how far she plans to go in terms of defining actors. Michele will use generic actors with general roles, such as Monitor, Researcher, etc. Mike confirmed with her that there would only be a half dozen or so. Mike thought that sounded appropriate for the upcoming deadline.
  - Michele: We can generate a draft, even incomplete, working together on this.
  - Mike: We need to please ourselves and allow us to get our work done without going into a full-blown needs assessment. We are developing a prototype with the nascent components for when it does get big. Nursery analogy: our goal is the pot of roots that can be planted to grow a full-blown tree.
  - System Requirements: Mike suggested we present these as we will the Business Requirements, using the rudimentary highest-level requirements for software and hardware. Keep it simple, don't go deeper down than that. We have a placeholder for the lower level requirements. There are many unknowns.
  - The tree will go in the Data Requirements section.
  - The details of the Data Dictionary will be in the Appendix.
  - Mike can work out the printing through his print shop.
  - Kim: The Access application can be put on the Internet.
  - A Glossary of Terms is necessary: Shane is currently working on this.
  - Also there will need to be a reference to Tracy Hillman's document, the latest version....
  - Lisa suggested that a full bibliography be included.
- Action Item:* Mike will send Michele his PowerPoint, the Empirical Road Map.

Timeline

- Receive responses from Mike Ward by April 23.
- First draft due on Wednesday May 5.
- Draft review will take place on Friday May 7, 10am-noon, at Spatial Dynamics' office. We will decide then when the final document will be due.
- Michele will be away May 12-19; Kim away May 17-21.
- Final Due Date: Kim asked to schedule the final due date for the end of May. Mike agreed with this, or later.
- Kim: When the document goes out for wider distribution review we might need more time.
- Mike: We could do wider distribution on or around May 14, and give maybe a one-week comment period. Comment period will be discussed later.

APPENDIX 2  
MONITORING PROTOCOLS

**Appendix 2**  
**Monitoring Protocols**

General Characteristics	Indicator	Reference	Subject	Spatial Scale	Framework	Data Structure	Sampling Frequency
Ecoregion	Baily classification	Bain and Stevenson (1999)	Composite classification veg climate etc	Regional setting	Geomorphic	Polygon or grid	20
	Omernik classification	Bain and Stevenson (1999)	Composite classification veg climate etc	Regional setting	Geomorphic	Polygon or grid	20
Physiography	Province	Bain and Stevenson (1999)	Pysigraphic classification	Regional setting	Geomorphic	Polygon or grid	20
Geology	Geologic district/Units	Overton et al (1997)	Geologic classification	Regional setting	Geomorphic	Polygon or grid	20
Geomorphic features	Basin area	Bain and Stevenson (1999)	Basin extent and boundary	Drainage basin	Geomorphic	Polygon or grid	20
	Basin relief	Bain and Stevenson (1999)	Topographic relief (DEM)	Drainage basin	Geomorphic	Grid	20
	Drainage density	Bain and Stevenson (1999)	Stream network density	Drainage basin	Geomorphic	Grid	20
	Stream order	Gordon et al (1992)	Stream order designation	Drainage basin	Geomorphic	Stream network, line	20
Valley characteristics	Valley bottom type	Cupp(1989); Naiman et al. (1992)	Local reach topography	Valley segment	Geomorphic	Polygon or grid	20
	Valley bottom width	Naiman et al. (1992)	Local reach topography	Valley segment	Geomorphic	Polygon or grid	20
	Valley bottom gradient	Naiman et al. (1992)	Local reach topography	Valley segment	Geomorphic	Grid	20
	Valley bottom containment	Bisson and Montgomery (1996)	Local reach topography	Valley segment	Geomorphic		20
Channel characteristics	Elevation	Overton et al (1997)	Channel elevation	Channel segment	Geomorphic	Grid	10
	Channel type, Rosgen	Rosgen (1996)	Channel type classification	Channel segment	Geomorphic	Grid or stream network	10
	Bed-form type	Bisson and Montgomery (1996)		Channel segment	Geomorphic		10
	Channel gradient	Overton et al (1997)	Channel gradient, elevation change	Channel segment	Geomorphic	Grid or stream network	10
	Riparian vegetation	Platts et al. (1983)	Riparian zone vegetation	Channel segment	Geomorphic	Polygon or grid	5
Adults	Escapement/number	Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Age structure	Borgerson (1992)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Size	Anderson and Neumann (1996)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Sex ratio	Strange (1996)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Origin (hatchery or wild)	Borgerson (1992)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Genetics	WDFW Genetics Lab	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Fecundity	Cailliet et al. (1986)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
Redds	Number	Mosey and Murphy (2002)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Distribution	Mosey and Murphy (2002)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
Parr/Juveniles	Abundance/Distribution	Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Size	Anderson and Neumann (1996)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
Smolts	Number	Murdoch et al. (1999)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Size	Anderson and Neumann (1996)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Genetics	WDFW Genetics Lab	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
Macroinvertebrates	Transport	Wipfli and Gregovich (2002)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
	Composition	Peck et al. (2001)	Biological indicator -Adults	Reach plus	Spatial; Protocol	Grid or stream network	1
Water Quality	MWMT/MDMT	Zorban (2000)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Hourly

**Appendix 2**  
**Monitoring Protocols**

General Characteristics	Indicator	Reference	Subject	Spatial Scale	Framework	Data Structure	Sampling Frequency
	Turbidity	OPSW (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Hourly
	Conductivity	OPSW (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Hourly
	pH	OPSW (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Hourly
	DO	OPSW (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Hourly
	Nitrogen	OPSW (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Seasonal / Quarterly
	Phosphorous	OPSW (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Seasonal / Quarterly
Habitat Access	Road crossings	Parker (2000); WDFW (2000)	Physical/environmental	Site; reach	Protocol; Sample	Occurrence	1
	Diversion dams	WDFW (2000)	Physical/environmental	Site; reach	Protocol; Sample	Occurrence	1
	Fishways	WDFW (2000)	Physical/environmental	Site; reach	Protocol; Sample	Occurrence	1
Habitat Quality	Dominant substrate	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Embeddedness	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Depth fines	Schuetz-Hames (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	LWD (pieces/km)	BURBTAC (1999)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Pools per kilometer	Hawkins et al. (1993); Overton et al. (1997)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Pool quality	Platts et al. (1983)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Off-channels habitat	WFPB (1983)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
Channel condition	Stream Gradient	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Width/depth ratio	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	0
	Wetted width	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Bankfull width	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Bank stability	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
Riparian Condition	Structure	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Disturbance	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
	Canopy cover	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	1
Flows and Hydrology	Streamflow	Peck et al. (2001)	Physical/environmental	Site; reach	Protocol; Sample	Sampling Site	Continuous
Watershed Condition	Watershed road density	WFC (1998); Reeves et al. (2001)	Physical/environmental	Watershed	Spatial	Polygon or grid	5
	Riparian-road index	WFC (1998)	Physical/environmental	Watershed	Spatial	Polygon or grid	5
	Land ownership	n/a	Physical/environmental	Drainage basin / watershed	Spatial	Polygon or grid	5
	Land use	Parmenter et al. (2003)	Physical/environmental	Drainage basin / watershed	Spatial	Polygon or grid	5

## APPENDIX 3

### PROTOCOLS AND REFERENCES

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Classification	Ecoregion	Bailey Classification	Bain and Stevenson (1999)  <u>Sub Quick Reference</u> Bailey, R.G. (1998)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.  <u>Sub Full Citation</u> Ecoregions map of North America: explanatory note. U.S. Forest Service, Intermountain Region, Ogden, UT.  <u>Web Reference</u> Domain, Divisions, and Province Descriptions <a href="http://www.fs.fed.us/land/ecosysmgmt/ecoreg1_home">www.fs.fed.us/land/ecosysmgmt/ecoreg1_home</a> Section Descriptions <a href="http://www.fs.fed.us/land/pubs/ecoregions/toc.html">www.fs.fed.us/land/pubs/ecoregions/toc.html</a>
		Omernik Classification	<u>Quick Reference</u> Bain and Stevenson (1999)  <u>Sub Quick Reference</u> Omernik, J.M. 1987.	<u>Full Citation</u> Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.  <u>Sub Full Citation</u> Omernik, J.M. 1987. Aquatic Ecoregion of the contiguous United States. Annals of the Association of American Geographers 77: 118-125.
	Physiography	Province	Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.
	Geology	Geologic district/ Units	Overton et. al (1997)	Overton, C. K., S. P. Wollrab, B. C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/ Intermountain Regions) fish and fish habitat standard inventory procedures handbook. USDA Forest Service General Technical Report INT-GTR-346, Ogden, UT.
	Geomorphic Features	Basin Area	Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.
		Basin Relief	Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.
		Drainage density	Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Classification	Geomorphic Features	Stream Order	<u><b>Called For</b></u> Gordon et al. (1992)	Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. Stream hydrology an introduction for ecologists. John Wiley and Sons, New York, NY.
			<u><b>Used</b></u> Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda MD.
	Valley Characteristics	Valley bottom type	<u><b>Called For</b></u> Cupp (1989)	Cupp, C.E. 1989a. Valley segment type classification for forested lands of Washington. Washington State Timber/ Fish/ Wildlife Agreement, TFW-AM-89-001, Department of Natural Resources, Olympia, WA.
			Naiman et al. (1992)	Naiman, R.J., D.G. Lonzarich, T.J. Beechie, and S.C. Ralph. 1992. General principles of classification and the assessment of conservation potential in rivers. Pages 93-123 in: P.J. Boon, P. Calow, and G.E. Petts, editors. River conservation and management. John Wiley and Sons, New York, NY.
		Valley bottom width	<u><b>Used</b></u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
			<u><b>Called For</b></u> Naiman et al. (1999)	Naiman, R.J., D.G. Lonzarich, T.J. Beechie, and S.C. Ralph. 1992. General principles of classification and the assessment of conservation potential in rivers. Pages 93-123 in: P.J. Boon, P. Calow, and G.E. Petts, editors. River conservation and management. John Wiley and Sons, New York, NY.
		Valley bottom gradient	<u><b>Used</b></u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
			<u><b>Called For</b></u> Naiman et al. (1999)	Naiman, R.J., D.G. Lonzarich, T.J. Beechie, and S.C. Ralph. 1992. General principles of classification and the assessment of conservation potential in rivers. Pages 93-123 in: P.J. Boon, P. Calow, and G.E. Petts, editors. River conservation and management. John Wiley and Sons, New York, NY.
		Valley bottom containment	<u><b>Called For</b></u> Bisson and Montgomery (1996)	Bisson, P.A. and D.R. Montgomery. 1996. Valley segments, stream reaches, and channel units. Pages 23-52 in: R.R. Hauer and G.A. Lamberti, editors. Methods in stream ecology. Academic Press, New York, NY.

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Classification			<u>Used</u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
	Channel Characteristics	Elevation	Overton et al. (1997)	Overton, C. K., S. P. Wollrab, B. C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/ Intermountain Regions) fish and fish habitat standard inventory procedures handbook. USDA Forest Service General Technical Report INT-GTR-346, Ogden, UT.
		Channel type, Rosgen	<u>Called For</u> Rosgen (1996) <u>Used</u> Hillman (2003)	Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO. Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Bed-form type	<u>Called For</u> Bisson and Montgomery (1996) <u>Used</u> Hillman (2003)	Bisson, P.A. and D.R. Montgomery. 1996. Valley segments, stream reaches, and channel units. Pages 23-52 in: R.R. Hauer and G.A. Lamberti, editors. Methods in stream ecology. Academic Press, New York, NY. Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Channel Gradient	Overton et al. (1997)	Overton, C. K., S. P. Wollrab, B. C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/ Intermountain Regions) fish and fish habitat standard inventory procedures handbook. USDA Forest Service General Technical Report INT-GTR-346, Ogden, UT.
		Riparian Vegetation	<u>Called For</u> Platts et al. (1983) <u>Used</u> Hillman (2003)	Platts, W. S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. USDA Forest Service General Technical Report INT_138, Ogden, UT. Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
Biological	Adults	Escapement / Number	<u>Called For</u> Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989) <u>Used</u> Hillman (2003)	Dolloff, A., J. Kershner, and R. Thurow. 1996. Underwater observation Pages 533 - 554 in: B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, MD. Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Age Structure	<u>Called For</u> Borgerson (1992) <u>Used</u> Hillman (2003)	Borgerson, L.A. 1992. Scale Analysis. Oregon Department of Fish and Wildlife, Fish Research Project F-144-R-4, Annual Progress Report, Portland, OR. Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Biological	Adults	Size	<u>Called For</u> Anderson and Neumann (1996)  <u>Used</u> Hillman (2003)	Anderson, R.O. and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in: B.R. Murphy and D.W. Willis, editors. Fisheries, 2nd edition. American Fisheries Society Bethesda, MD.  Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Sex Ratio	<u>Called For</u> Strange (1996)  <u>Used</u> Hillman (2003)	Strange, R.J. 1996. Field examinations of fishes. Pages 433-446 in: B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, MD.  Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Origin (hatchery or wild)	<u>Called For</u> Borgerson (1992)  <u>Used</u> Hillman (2003)	Borgerson, L.A. 1992. Scale Analysis. Oregon Department of Fish and Wildlife, Fish Research Project F-144-R-4, Annual Progress Report, Portland, OR.  Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Genetics	WDFW Genetics Lab	WDFW (Washington Department of Fish and Wildlife). 2000. Fish passage barrier and surface water diversion screening assessment and prioritization manual. Washington Department of Fish and Wildlife Habitat Program, Environmental Restoration Division, Olympia, WA.  <u>Web Reference</u> <a href="http://wdfw.wa.gov/hab/engineer/fishbarr">http://wdfw.wa.gov/hab/engineer/fishbarr</a>
		Fecundity	<u>Called For</u> Cailliet et al. (1986)  <u>Used</u> Hillman (2003)	Cailliet, G.M., M.S. Love, and A.W. Ebeling. 1986. Fishes, a field and laboratory manual on their structure, identification, and natural history. Wadsworth Publishing Company, Belmont, CA.  Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
	Redds	Number	<u>Called For</u> Mosey and Murphy (2002)  <u>Used</u> Hillman (2003)	Mosey, T.R. and L.J. Murphy. 2002. Spring and summer Chinook spawning ground surveys on the Wenatchee River Basin, 2001. Chelan County Public Utility District, Wenatchee, WA.  Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Biological	Redds	Distribution	<u>Called For</u> Mosey and Murphy (2002)	Mosey, T.R. and L.J. Murphy. 2002. Spring and summer Chinook spawning ground surveys on the Wenatchee River Basin, 2001. Chelan County Public Utility District, Wenatchee, WA.
			<u>Used</u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
	Parr / Juveniles	Abundance / Distributions	<u>Called For</u> Dolloff et al. (1996); Reynolds (1996); Van Deventer and Platts (1989)	Dolloff, A., J. Kershner, and R. Thurow. 1996. Underwater observation Pages 533 - 554 in: B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, MD.
			<u>Used</u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
	Smolts	Size	<u>Called For</u> Anderson and Neumann (1996)	Anderson, R.O. and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in: B.R. Murphy and D.W. Willis, editors. Fisheries, 2nd edition. American Fisheries Society Bethesda, MD.
			<u>Used</u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Number	<u>Called For</u> Murdoch et al. (1996)	Murdoch, A., K. Petersen, T. Miller, M. Tonseth, and T. Randolph. 1999. Freshwater production and emigration of juvenile spring Chinook salmon from the Chiwawa River in 1998. Report N. SS99-05, Washington Department of Fish and Wildlife, Olympia, WA.
			<u>Used</u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Size	<u>Called For</u> Anderson and Neumann (1996)	Anderson, R.O. and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in: B.R. Murphy and D.W. Willis, editors. Fisheries, 2nd edition. American Fisheries Society Bethesda, MD.
			<u>Used</u> Hillman (2003)	Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Genetics	WDFW Genetics Lab	WDFW (Washington Department of Fish and Wildlife). 2000. Fish passage barrier and surface water diversion screening assessment and prioritization manual. Washington Department of Fish and Wildlife Habitat Program, Environmental Restoration Division, Olympia, WA.

### Appendix 3 Protocols and References

<b>Indicator Group</b>	<b>General Characteristics</b>	<b>Specific Indicators</b>	<b>Quick Reference</b>	<b>Full Citation</b>
Biological	Macroinvertebrates	Transport	Wipfli and Gregovich (2002)	Wipfli, M.S. and D.P. Gregovich. 2002. Export of invertebrates and detritus from fishless headwater streams in southeastern Alaska: implications for downstream salmonid production. <i>Freshwater Biology</i> 47:957-969.
		Composition	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <u><b>Web Reference</b></u> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html</a>
Habitat / Physical	Water Quality	MWMT/MDMT	Zaroban (2000)	Zaroban, D.W. 2000. Protocol for placement and retrieval of temperature data loggers in Idaho streams. Idaho Division of Environmental Quality, Boise, ID.  <u><b>Web Reference</b></u> <a href="http://www.deq.state.id.us/water/tlp.htm">http://www.deq.state.id.us/water/tlp.htm</a>
		Turbidity	OPSW (1999)	OPSW (Oregon Plan for Salmon and Watersheds). 1999. Water quality monitoring, technical guide book. Version 2.0 Corvallis, OR.  <u><b>Web Reference</b></u> <a href="http://www.oweb.state.or.us/publications/index.shtml">http://www.oweb.state.or.us/publications/index.shtml</a>
		Conductivity	OPSW (1999)	OPSW (Oregon Plan for Salmon and Watersheds). 1999. Water quality monitoring, technical guide book. Version 2.0 Corvallis, OR.  <u><b>Web Reference</b></u> <a href="http://www.oweb.state.or.us/publications/index.shtml">http://www.oweb.state.or.us/publications/index.shtml</a>
		pH	OPSW (1999)	OPSW (Oregon Plan for Salmon and Watersheds). 1999. Water quality monitoring, technical guide book. Version 2.0 Corvallis, OR.  <u><b>Web Reference</b></u> <a href="http://www.oweb.state.or.us/publications/index.shtml">http://www.oweb.state.or.us/publications/index.shtml</a>
		DO	OPSW (1999)	OPSW (Oregon Plan for Salmon and Watersheds). 1999. Water quality monitoring, technical guide book. Version 2.0 Corvallis, OR.

**Appendix 3**  
**Protocols and References**

<b>Indicator Group</b>	<b>General Characteristics</b>	<b>Specific Indicators</b>	<b>Quick Reference</b>	<b>Full Citation</b>
Habitat / Physical	Water Quality	DO	OPSW (1999)	<p><b><u>Web Reference</u></b>  <a href="http://www.oweb.state.or.us/publications/index.shtml">http://www.oweb.state.or.us/publications/index.shtml</a></p>
		Nitrogen	OPSW (1999)	<p>OPSW (Oregon Plan for Salmon and Watersheds). 1999. Water quality monitoring, technical guide book. Version 2.0 Corvallis, OR.</p> <p><b><u>Web Reference</u></b>  <a href="http://www.oweb.state.or.us/publications/index.shtml">http://www.oweb.state.or.us/publications/index.shtml</a></p>
		Phosphorous	OPSW (1999)	<p>OPSW (Oregon Plan for Salmon and Watersheds). 1999. Water quality monitoring, technical guide book. Version 2.0 Corvallis, OR.</p> <p><b><u>Web Reference</u></b>  <a href="http://www.oweb.state.or.us/publications/index.shtml">http://www.oweb.state.or.us/publications/index.shtml</a></p>
		FLIR / Temperature	Torgersen (2000)	Torgersen, C.E., R.N. Faux, B.A. McIntosh, N. J. Poage, and D.J. Borton. 2000. Airborne thermal remote sensing for water temperature assessment in rivers and streams. Remote Sensing of Environment 76 (2001) 386-398.
	Habitat Access	Road Crossing	Parker (2000)	Parker, M.A. 2000. Fish passage - culvert inspection procedures. Watershed Restoration Technical Circular No. 11. Ministry of Environment, Lands and Parks and Ministry of Forest, British Columbia
			WDFW (2000)	<p>WDFW (Washington Department of Fish and Wildlife). 2000. Fish passage barrier and surface water diversion screening assessment and prioritization manual. Washington Department of Fish and Wildlife Habitat Program, Environmental Restoration Division, Olympia, WA.</p> <p><b><u>Web Reference</u></b>  <a href="http://wdfw.wa.gov/hab/engineer/fishbarr">http://wdfw.wa.gov/hab/engineer/fishbarr</a></p>
		Diversion Dams	WDFW (2000)	<p>WDFW (Washington Department of Fish and Wildlife). 2000. Fish passage barrier and surface water diversion screening assessment and prioritization manual. Washington Department of Fish and Wildlife Habitat Program, Environmental Restoration Division, Olympia, WA.</p> <p><b><u>Web Reference</u></b>  <a href="http://wdfw.wa.gov/hab/engineer/fishbarr">http://wdfw.wa.gov/hab/engineer/fishbarr</a></p>

### Appendix 3 Protocols and References

<b>Indicator Group</b>	<b>General Characteristics</b>	<b>Specific Indicators</b>	<b>Quick Reference</b>	<b>Full Citation</b>
Habitat / Physical	Habitat Access	Fishways	WDFW (2000)	<p>WDFW (Washington Department of Fish and Wildlife). 2000. Fish passage barrier and surface water diversion screening assessment and prioritization manual. Washington Department of Fish and Wildlife Habitat Program, Environmental Restoration Division, Olympia, WA.</p> <p><b>Web Reference</b>  <a href="http://wdfw.wa.gov/hab/engineer/fishbarr">http://wdfw.wa.gov/hab/engineer/fishbarr</a></p>
	Habitat Quality	Dominant Substrate	Peck et al. (2001)	<p>Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.</p> <p><b>Web Reference</b>  <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html</a></p>
		Embeddedness	Peck et al. (2001)	<p>Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.</p> <p><b>Web Reference</b>  <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html</a></p>
		Depth Fines	Schuett-Hames (1999)	<p>Schuett-Hames, D., R. Conrad, A. Pleus, and M. McHenry. 1999b. Method manual for the salmonid spawning gravel composition survey. Timber-Fish-Wildlife TFW-AM9-99-006, Northwest Indian Fisheries Commission, Olympia, WA.</p> <p><b>Web Reference</b>  <a href="http://www.nwifc.wa.gov/TFW/documents.asp">http://www.nwifc.wa.gov/TFW/documents.asp</a></p>
		LWD (pieces / km)	BURPTAC (1999)	<p>BURPTAC (Beneficial Use Reconnaissance Project Technical Advisory Committee). 1999. 1999 beneficial use reconnaissance project work plan for wadeable streams. Idaho Division of Environmental Quality, Boise, ID.</p> <p><b>Web Reference</b>  <a href="http://www.deq.state.id.us/water/surface_water/99_burp_workplan.pdf">http://www.deq.state.id.us/water/surface_water/99_burp_workplan.pdf</a></p>

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Habitat / Physical	Habitat Quality	Pools per kilometer	Hawkins et al. (1993)  Overton et al (1997)	Hawkins, C.P. and ten others. 1993. Hierarchical approach to classifying stream habitat features. Fisheries 18:3-12.  Overton, C. K., S. P. Wollrab, B. C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/ Intermountain Regions) fish and fish habitat standard inventory procedures handbook. USDA Forest Service General Technical Report INT-GTR-346, Ogden, UT.
		Pool quality	<u>Called For</u> Platts et al. (1983)  <u>Used</u> Hillman (2003)	Platts, W.S. and twelve others. 1987. Methods for evaluating riparian habitats with applications to management. USDA Forest Service General Technical Report INT-221, Ogden, UT.  Hillman, T.W. 2003. Monitoring Strategy For The Upper Columbia Basin. Draft Report. BioAnalysts, Inc. Eagle, Idaho.
		Off-channels habitat	WFPB (1983)	WFPB (Washington Forest Practices Board). 1995. Washington forest practices board manual: Standard methodology for conducting watershed analysis under Chapter 222-22 WAC. Version 3.0. Washington Forest Practices Board, Olympia, WA.  <u>Web Reference</u> <a href="http://www.dnr.wa.gov/forestpractices/watershedanalysis/">http://www.dnr.wa.gov/forestpractices/watershedanalysis/</a>
	Channel Condition	Width/depth ratio	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <u>Web Reference</u> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html</a>
		Wetted Width	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <u>Web Reference</u> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html</a>

**Appendix 3**  
**Protocols and References**

<b>Indicator Group</b>	<b>General Characteristics</b>	<b>Specific Indicators</b>	<b>Quick Reference</b>	<b>Full Citation</b>
Habitat / Physical	Channel Condition	Bankfull width	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <b><u>Web Reference</u></b> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html</a>
		Bank Stability	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <b><u>Web Reference</u></b> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html</a>
	Riparian Condition	Structure	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <b><u>Web Reference</u></b> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html</a>
		Disturbance	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <b><u>Web Reference</u></b> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewws/m01.html</a>
		Canopy Cover	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.

### Appendix 3 Protocols and References

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Habitat / Physical	Riparian Condition	Canopy Cover		<u><b>Web Reference</b></u> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html</a>
	Flows and Hydrology	Streamflow	Peck et al. (2001)	Peck, D.V., J.M. Lazorchak, and D.J. Klemm. 2001. Environmental monitoring and assessment program--surface waters: western pilot study field operations manual for wadeable streams. Draft Report. EPA/XXX/X-XX/XXX, U.S. Environmental Protection Agency, Washington, D.C.  <u><b>Web Reference</b></u> <a href="http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html">http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.html</a>
	Watershed Condition	Watershed road density	WFC (1998)  Reeves et al. (2001)	WFC (World Forestry Center). 1998. Pilot study report, Umpqua land exchange project. World Forestry Center, Portland, OR.  Reeves, G.H., and nine others. 2001. Aquatic and riparian effectiveness monitoring plan for the Northwest Forest plan. USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR.
		Riparian-road index	<u><b>Called For</b></u> WFC (1998)  <u><b>Used</b></u> Reeves et al. (2001)	WFC (World Forestry Center). 1998. Pilot study report, Umpqua land exchange project. World Forestry Center, Portland, OR.  Reeves, G.H., and nine others. 2001. Aquatic and riparian effectiveness monitoring plan for the Northwest Forest plan. USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR.
		Land Ownership	n/a	
		Land Use	Parmenter et al. (2003)	Parmenter, A. W., A. Hansen, R.E. Kennedy, W. Cohen, U. Langener, R. Lawrence, B. Maxwell, A. Gallant, and R. Aspinall. 2003. Land use and land cover in the greater Yellowstone ecosystem: 1975-1995. Ecological Applications 13:687-703.

APPENDIX 4

SAMPLE FIELD FORM – STREAM VERIFICATION

## Stream Verification

Site Name:	<input type="text"/>	Date:	<input type="text"/>	Visit:	<input type="text" value="0"/>
Site ID:	<input type="text"/>	Team:	<input type="text"/>		

### STREAM/RIVER VERIFICATION INFORMATION

Stream/River Verified by (X all that apply): ☐ GPS ☐ Local Contact ☐ Signs ☐ Roads ☐ Topo Map  
☐ Other (Explain in Comments): ☐ Not Verified (Explain in Comments):

Coordinates	Latitude North	Latitude West	GPS RMS Error	GPS PDOP Error
MAP	<input type="text" value="0"/> Decimal Degrees	<input type="text" value="0"/> Decimal Degrees	<input type="text" value="0"/>	<input type="text" value="0"/>
GPS	<input type="text" value="0"/> Decimal Degrees	<input type="text" value="0"/> Decimal Degrees		

### DID YOU SAMPLE THIS SITE?

<input checked="" type="checkbox"/> Yes      If YES, check one below	<input checked="" type="checkbox"/> No      If NO, check one below
<b>Sampleable (Choose method used)</b> <input type="checkbox"/> Wadeable - Continuous water, greater than 50% wadeable <input type="checkbox"/> Boatable - Continuous water, greater than 50% boatable <input type="checkbox"/> Partial - Sampled by Wading (explain in comments) <input type="checkbox"/> Partial - Sampled by Boat (explain in comments) <input type="checkbox"/> Wadeable Interrupted - Water not continuous along reach <input type="checkbox"/> Boatable Interrupted - Water not continuous along reach <input type="checkbox"/> Altered - Stream/river present but not as shown on map	<b>Non-Sampleable-Permanent</b> <input type="checkbox"/> Dry - Visited <input type="checkbox"/> Dry - Not visited <input type="checkbox"/> Wetland (no definable channel) <input type="checkbox"/> Map Error - No evidence channel / waterbody ever present <input type="checkbox"/> Impounded (underneath lake or pond) <input type="checkbox"/> Other (explain in comments)  <b>Non-Sampleable-Temporary</b> <input type="checkbox"/> Not Boatable - Need a different crew <input type="checkbox"/> Not Wadeable - Need a different crew <input type="checkbox"/> Other (explain in comments)  <b>No Access</b> <input type="checkbox"/> Access Permission Denied <input type="checkbox"/> Permanently Inaccessible (unable/unsafe to reach site) <input type="checkbox"/> Temporarily Inaccessible - Fire, etc. (explain in comments)

General Comments:

Limit 250 words

Directions to Stream / River Site:

Limit 250 words

APPENDIX 5

MONITORING DATA DICTIONARY HELP DOCUMENT

## John Day Basin Research Monitoring and Evaluation Pilot Project

Monitoring Data Dictionary Help Document  
May 05, 2004



**U.S. Bureau of Reclamation**  
**Pacific Northwest Regional Office**

**Spatial Dynamics Inc.**  
**Boise, Idaho**

**commonthread inc.**  
**Boise, Idaho**

The John Day Basin Research Monitoring Data Dictionary was designed in a Microsoft Access database format for easy navigation and viewing. The protocols and their attributes that are associated with the monitoring of this watershed have been organized by the four major categories that appear in Tracy Hillman's *Monitoring Strategy for the Upper Columbia Basin*:

**General Characteristics:** an overall list of all protocols.

**Specific Indicators:** organization of attributes contained in each protocol.

**Indicator Groups:** organization of protocols into three major categories - Classification, Biological, and Habitat / Physical.

**Sample Sites:** used to provide access to four site categories.

This is the main start-up page for the data dictionary. To begin, click **Start Here**.

The screenshot shows a Microsoft Access form titled "frmStartHere : Form". The form has a green border and contains the following elements:

- A green box with the text "John Day RME Pilot Project".
- A green box with the text "Upper Columbia Basin Monitoring Strategy Protocol Form".
- A map of the Upper Columbia Basin watershed.
- Two buttons: "Start Here" and "Quit".
- A status bar at the bottom showing "Record: 1 of 1" and "Spatial Dynamics, 2004".

After you click **Start Here**, the overall navigation window comes up. All protocols and attributes can be accessed within the window. References and hyperlinks are also available from this form. Each protocol is shown in the **General Characteristics** box.

The screenshot shows a window titled "Dictionary" with a blue header. On the left, there are two main sections: "General Characteristics" and "Specific Indicators". The "General Characteristics" section contains a list of protocols: Ecoregion, Physiography, Geology, Geomorphic Features, Valley Characteristics, Channel Characteristics, Adults, Redds, Parr / Juveniles, Smolts, Macroinvertebrates, Water Quality, Habitat Access, Habitat Quality, Channel Condition, Riparian Condition, Flows and Hydrology, Watershed Condition, X-Site, Point Sample, Cross-Sectional Transects, and Reach Sample Site. Below this list are "Indicator Groups" (Classification, Biological, Habitat / Physical) and "Sample Sites" (X-Site, Point Sample, Cross-Sectional Transects, Reach Sample Site). A "References" button is at the bottom left. The "Specific Indicators" section is currently empty. To the right of these sections is a large table with columns: Domain, Attribute, Units, Data Type, Precision, Description, Comment, SD Comments, and Hyperlinks. At the bottom left, it says "Record: 14 of 1".

When an individual protocol name is highlighted in the selection box, the **Specific Indicators** box is automatically filled in with the appropriate variables.

This screenshot shows the same "Dictionary" window, but now the "Ecoregion" protocol in the "General Characteristics" list is highlighted. The "Specific Indicators" section is now populated with two items: "Bailey Classification" and "Omernik Classification". The rest of the interface, including the table and record information, remains the same as in the previous screenshot.

When a variable in the **Specific Indicators** box is highlighted, the rest of the form will automatically be populated with the associated attributes.

The Dictionary window displays the following data:

Domain	Attribute	Units	Data Type	Precision	Description	Comment	SD Comments	Hyperlinks
Nationwide	Site ID	N/A	Variable Text	N/A	unique site id value given to research site		sh	<a href="#">Bain</a>
Nationwide	Data Collector	N/A	Variable Text	N/A	initials of data collector		sh	
Nationwide	Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data		sh	
Nationwide	Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey		sh	
Nationwide	Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey		sh	
Nationwide	Watershed Name	N/A	Variable Text	N/A	name of watershed		sh	
Nationwide	Hydrologic Unit	N/A	Variable Text	N/A	unit name		sh	

Record: 1 of 19

Moving the **slider bar** on the right enables you to view all attributes in an individual category.

Using the **record selector** at the bottom of the form lets you access each individual attribute.

**Hyperlinks** can be reached by clicking on the hyperlink.

To access information that exceeds the cell space, use the scroll bars.

The Dictionary window displays the following data:

Domain	Attribute	Units	Data Type	Precision	Description	Comment	SD Comments	Hyperlinks
Nationwide	Site ID	N/A	Variable Text	N/A	unique site id value given to research site		sh	<a href="#">Bain</a>
Nationwide	Data Collector	N/A	Variable Text	N/A	initials of data collector		sh	
Nationwide	Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data		sh	
Nationwide	Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey		sh	
Nationwide	Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey		sh	
Nationwide	Watershed Name	N/A	Variable Text	N/A	name of watershed		sh	
Nationwide	Hydrologic Unit	N/A	Variable Text	N/A	unit name		sh	

Record: 1 of 19

Clicking the **reference** button retrieves the reference sheet. See the following page for a sample reference spreadsheet.

Below is a sample **References** spreadsheet, created in Excel.

Indicator Group	General Characteristics	Specific Indicators	Quick Reference	Full Citation
Classification	Ecoregion	Bailey Classification	Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda, MD.
			<b>Sub Quick Reference</b>	<b>Sub Full Citation</b>
			Bailey, R.G. (1998)	Ecoregions map of North America: explanatory note. U.S. Forest Service, Intermountain Region, Ogden, UT.
				<b>Web Reference</b>
				Domain, Divisions, and Province Descriptions: <a href="http://www.fs.fed.us/land/ecosysmante/coreg1_home">www.fs.fed.us/land/ecosysmante/coreg1_home</a> Section Descriptions <a href="http://www.fs.fed.us/land/pubs/ecoregions/toc.html">www.fs.fed.us/land/pubs/ecoregions/toc.html</a>
		Omerik Classification	<b>Quick Reference</b>	<b>Full Citation</b>
			Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda, MD.
			<b>Sub Quick Reference</b>	<b>Sub Full Citation</b>
			Omerik, J.M. 1987.	Omerik, J.M. 1987. Aquatic ecoregion of the continues United States. Annals of the Association of American Geographers 77: 118-125.
	Physiography	Province	Bain and Stevenson (1999)	Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic habitat assessment: common methods. American Fisheries Society, Bethesda, MD.
	Geology	Geologic district/Units	Overton et. al (1997)	Overton, C.K., S. P. Wolrab, B. C. Roberts, and M.A. Radio. 1997. R1/R4 (Northern/ Intermountain Regions) fish and fish habitat standard inventory procedures handbook. USDA Forest

To continue working, close the spreadsheet to return to the database.

When you select different **option buttons**, only those protocols associated with the selected **Indicator Group** or **Sample Site** are shown.

**Dictionary**

**General Characteristics**

- ☒ Ecoregion
- ☐ Physiography
- ☐ Geology
- ☐ Geomorphic Features
- ☐ Valley Characteristics
- ☐ Channel Characteristics

**Indicator Groups**

- ☒ Classification
- ☐ Biological
- ☐ Habitat / Physical

**Sample Sites**

- ☒ X-Site
- ☐ Point Sample
- ☐ Cross-Sectional Transects
- ☐ Reach Sample Site

**References**

Domain	Attribute	Units	Data Type	Precision	Description	Comment	SD Comments	Hyperlinks
--------	-----------	-------	-----------	-----------	-------------	---------	-------------	------------

Record: 1 of 1

Selecting the **option buttons** a second time (turning them off) will return all of the protocols to the **General Characteristics** box.

To quit, close the database.

APPENDIX 6  
DATA DICTIONARY

<b>General Characteristic: Ecoregion</b>		<b>Specific Indicator Bailey Classification</b>		<b>Domain Nationwide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Bailey Classification</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Watershed Name	N/A	Variable Text	N/A	name of watershed	
Hydrologic Unit Name	N/A	Variable Text	N/A	unit name	
Domain Number	N/A	Variable Text	N/A	domain numbers	100-Polar Domain----200-Humid Temperate Domain---300-Dry Domain----400-Humid Tropical Domain
Domain Name	N/A	Variable Text	N/A	domain names	Polar, Humid Temperate Dry Domain, Humid Tropical
Division Number	N/A	Variable Text	N/A	division numbers	
Division Name	N/A	Variable Text	N/A	division name	
Province Number	N/A	Variable Text	N/A	province numbers	
Province Name	N/A	Variable Text	N/A	province names	
Land Surface Form Description	N/A	Variable Text	N/A	description of surrounding land surface forms- info obtained from Baileys classification	250 words or less
Climate Description	N/A	Variable Text	N/A	description of climate- info obtained from Baileys classificatior	250 words or less

<b>General Characteristic: Ecoregion</b>		<b>Specific Indicator Bailey Classification</b>		<b>Domain Nationwide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Vegetation Description	N/A	Variable Text	N/A	description of vegetation - info obtained from Baileys classificatior	250 words or less
Soils Description	N/A	Variable Text	N/A	description of soils - info obtained from Baileys classification	250 words or less
Fauna	N/A	Variable Text	N/A	description of fauna - info obtained from Baileys classification	250 words or less
Comments	N/A	Variable Text	N/A	data gatherer's comments	

<b>General Characteristic: Ecoregion</b>		<b>Specific Indicator Omernik Classification</b>		<b>Domain Nationwide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Omernik Classification</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Watershed Name	N/A	Variable Text	N/A	name of watershed	
Hydrologic Unit Name	N/A	Variable Text	N/A	unit name	
Level 1 Ecoregion	N/A	Variable Text	1 through 9	coarsest of ecoregion in North America	
Level 2 Ecoregion	N/A	Variable Text	32 classes		
Level 3 Ecoregion	N/A	Variable Text	78 classes	land surface form, potential natural vegetation, land use, and soils	
Land Surface Form Description	N/A	Variable Text	N/A	description of land-surface form - info obtained from Omernik's classification	250 words or less
Potential Natural Vegetations	N/A	Variable Text	N/A	description of potential natural vegetation - info obtained from Omerniks classification	250 words or less
Land Use	N/A	Variable Text	N/A	description of land use - info obtained from Omernik's classification	250 words or less
Soils Description	N/A	Variable Text	N/A	description of soils - info obtained from Omerniks classification	250 words or less
Comments	N/A	Variable Text	N/A	data gatherer's comments	

<b>General Characteristic:</b> <b>Physiography</b>		<b>Specific Indicator</b> <b>Province</b>		<b>Domain</b> <b>Nationwide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Province</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text		data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting data of survey	
Survey End Data	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Site Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site latitude in decimal degrees	determined from gps unit, topo maps, etc.
Site Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site longitude in decimal degrees	determined from gps unit, topo maps, etc.
Division Number	N/A	Variable Text	N/A	division numbers	11 total
Division Name	N/A	Variable Text	N/A	division names	11 total
Province Name	N/A	Variable Text	N/A	name of province	
Province Description	N/A	Variable Text	N/A	based on topography	mountain, plains, plateaus, and uplands--to a lesser degree---climate
Province Climate Description	N/A	Variable Text	N/A	description of climate	
Province Vegetation	N/A	Variable Text	N/A	description of vegetation	
Province Surficial Deposits and Soils	N/A	Variable Text	N/A	description of soils	
Water Resources	N/A	Variable Text	N/A	description of water resources	
Mineral Resources	N/A	Variable Text	N/A	description of minerals	
Comments	N/A	Variable Text	N/A	data gatherer's comments	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Geology</b>		<b>Geologic districts / Units</b>		<b>Nation Wide</b>	
Attribute	Units	Data Type	Precision	Description	Comment
<b>Geologic districts / Units</b>					
Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting data of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Basin Name	N/A	Variable Text	N/A	name of basin where research is taking place	
Basin Area	sq miles	Floating Point	XXXXXX.XX	sq miles of basin	
Main Water Feature	N/A	Variable Text	N/A	name of main water feature in study area	
Dominant Vegetation Cover	N/A	Variable Text	wooded, meadow	type of dominant vegetation type	
Valley Confinement	N/A	Variable Text	confined, modera	confinement of valley	confined: valley width is narrow; channel is narrow and deep moderately confined; moderately confined, channel moderate unconfined; valley width is broad; flood plain is well developed#confined: valley width is narrow; channel is narrow and deep moderately confined; moderately confined, channel moderate unconfined; valley width is broad; flood plain is well developed#
Gross Geology	N/A	Variable Text	Plutonic, Volcani	dominant geology for drainage basin	one or many--need access to geology maps or geologist
Subgeology	N/A	Variable Text	Granite-Diorite,	further breakdown of gross geology	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Geology</b>		<b>Geologic districts / Units</b>		<b>Nation Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Geologist Name	N/A	Variable Text	N/A	name of Geologist	
Geologist Contact #	N/A	Phone number	N/A	phone number of geologist	

<b>General Characteristic: Geomorphic Features</b>		<b>Specific Indicator Basin Area</b>		<b>Domain Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Basin Area</i></b>					
Drainage Basin ID	N/A	Variable Text	N/A	unique basin id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Drainage Basin Name	N/A	Variable Text	N/A	name of drainage basin	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Main Water Feature Name	N/A	Variable Text	N/A	name of main water feature occupying drainage basin	
Map Name	N/A	Variable Text	N/A	name of map that information was derived from	
Map Source	N/A	Variable Text	N/A	source of map	USGS, Forest Service, etc.
GIS Name	N/A	Variable Text	N/A	name of GIS stream layers	could contain environmental descriptors
GIS Source Entity	N/A	Variable Text	N/A	source of GIS information	Where did GIS info come from
GIS Source Contact	N/A	Variable Text	N/A	Name of contact to get GIS info	who to contact to get GIS info
GIS Source Contact Number	N/A	Variable Text	N/A	phone number of contact for getting data	who to contact to get GIS info
Map Scale	N/A	Variable Text	exp. 1:24000	scale of map	
Basin Area	sq miles	Floating Point	XXXXXX.XX	area of drainage basin	

<b>General Characteristic:</b> <b>Geomorphic Features</b>		<b>Specific Indicator</b> <b>Basin Relief</b>		<b>Domain</b> <b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Basin Relief***

Drainage Basin ID	N/A	Variable Text	N/A	unique basin id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Drainage Basin Name	N/A	Variable Text	N/A	name of drainage basin	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Main Water Feature Name	N/A	Variable Text	N/A	name of main water feature occupying drainage basin	
Map Name	N/A	Variable Text	N/A	name of map that information was derived from	
Map Source	N/A	Variable Text	N/A	source of map	USGS, Forest Service, etc.
GIS Name	N/A	Variable Text	N/A	name of GIS stream layers	
GIS Source Entity	N/A	Variable Text	N/A	source of GIS information	Where did GIS info come from
GIS Source Contact	N/A	Variable Text	N/A	Name of contact to get GIS info	who to contact to get GIS info
GIS Source Contact Number	N/A	Variable Text	N/A	phone number of contact for getting data	who to contact to get GIS info
Map Scale	N/A	Variable Text	exp. 1:24000	scale of map	
Elevation Max	Meters	Floating Point	XXXXXX.XX	elevation of highest point in basin	
Elevation Min	Meters	Floating Point	XXXXXX.XX	elevation at lowest point in basin	
Elevation Max Point Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site latitude in decimal degrees	

<b>General Characteristic:</b> <b>Geomorphic Features</b>		<b>Specific Indicator</b> <b>Basin Relief</b>		<b>Domain</b> <b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Elevation Max Point Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site longitude in decimal degrees	
Elevation Min Point Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site latitude in decimal degrees	
Elevation Min Point Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site longitude in decimal degrees	
Basin Relief	Ft.	Floating Point	XXXXXX.XX	basin max-basin min	

<b>General Characteristic:</b> <b>Geomorphic Features</b>		<b>Specific Indicator</b> <b>Drainage Density</b>		<b>Domain</b> <b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Drainage Density</i></b>					
Drainage Basin ID	N/A	Variable Text	N/A	unique basin id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Drainage Basin Name	N/A	Variable Text	N/A	name of drainage basin	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Main Water Feature Name	N/A	Variable Text	N/A	name of main water feature occupying drainage basin	
Map Name	N/A	Variable Text	N/A	name of map that information was derived from	
Map Source	N/A	Variable Text	N/A	source of map	USGS, Forest Service, etc.
GIS Name	N/A	Variable Text	N/A	name of GIS stream layers	could contain environmental descriptors
GIS Source Entity	N/A	Variable Text	N/A	source of GIS information	Where did GIS info come from
GIS Source Contact	N/A	Variable Text	N/A	Name of contact to get GIS info	who to contact to get GIS info
GIS Source Contact Number	N/A	Variable Text	N/A	phone number of contact for getting data	who to contact to get GIS info
Map Scale	N/A	Variable Text	exp. 1:24000	scale of map	
Perennial Stream Length	Km / Km2	Floating Point	XXXXXX.XX	total length of all streams in basin that are present year around	

<b>General Characteristic:</b> <b>Geomorphic Features</b>		<b>Specific Indicator</b> <b>Drainage Density</b>		<b>Domain</b> <b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Intermittent Stream Length	Km / Km2	Floating Point	XXXXXX.XX	total length of all streams in basin that are present on an intermittent basis	
Basin Area	Km / Km2	Floating Point	XXXXXX.XX	area of drainage basin	
Drainage Density	Km / Km2	Floating Point	XXXXXX.XX	total length of streams/area of basin	

<b>General Characteristic: Geomorphic Features</b>		<b>Specific Indicator Stream Order</b>		<b>Domain Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Stream Order</b>					
Drainage Basin Name	N/A	Variable Text	N/A	name of drainage basin	
Drainage Basin ID	N/A	Variable Text	N/A	unique basin id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Main Water Feature Name	N/A	Variable Text	N/A	name of main water feature occupying drainage basin	
Map Name	N/A	Variable Text	N/A	name of map that information was derived from	
Map Source	N/A	Variable Text	N/A	source of map	USGS, Forest Service, etc.
GIS Name	N/A	Variable Text	N/A	name of GIS stream layers	could contain environmental descriptors
GIS Source Entity	N/A	Variable Text	N/A	source of GIS information	Where did GIS info come from
GIS Source Contact	N/A	Variable Text	N/A	Name of contact to get GIS info	who to contact to get GIS info
GIS Source Contact Number	N/A	Variable Text	N/A	phone number of contact for getting data	who to contact to get GIS info
Map Scale	N/A	Variable Text	exp. 1:24000	scale of map	
Stream Order Method	N/A	Variable Text	Strahler, Link Sy	method used to order streams	
Strahler System Order	N/A	Variable Text	1, N+1, N+2, etc.	n is highest order, no streams above	

<b>General Characteristic:</b> <b>Geomorphic Features</b>		<b>Specific Indicator</b> <b>Stream Order</b>		<b>Domain</b> <b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Link System Order	N/A	Variable Text	1+1 = 2, 2+1 = 3	add stream order number together to get new stream number	

<b>General Characteristic:</b> <b>Valley Characteristics</b>		<b>Specific Indicator</b> <b>Valley Bottom Type</b>		<b>Domain</b> <b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Valley Bottom Type</b>					
Sample Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting data of survey	
Survey End Data	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	
Valley Bottom Gradient	%	Floating Point	XXX%	measure in length of about 300 m	ratio of valley bottom width (m) to active channel width
Channel Patterns	N/A	Variable Text	N/A	constrained, highly constrained, unconstrained, etc.	
Strahler Stream Order	N/A	Variable Text	N/A	stream order of stream in basin	
Valley Confinement	%	Floating Point	XXX%	valley floor width / channel widths	hillslopes within 1000 horizontal m and 100 vertical m distance from channel
Valley Bottom Type	N/A	Variable Text	N/A	f1,f2,f3,f4,f5,m1,m2,v1,v2,v3,v4,u1,u2,u3,u4,h1,h2,h3	see included table
Basin Name	N/A	Variable Text	N/A	name of basin in study	
Valley Bottom Width	ratio	Floating Point	exp. <2X	ratio of valley bottom width to active channel width	meters/meters

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Valley Characteristics</b>		<b>Valley Bottom Width</b>		<b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Valley Bottom Width</b>					
Sample Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Basin Name	N/A	Variable Text	N/A	name of basin in study	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Valley Bottom Width	ratio	Floating Point	exp. <2X	ratio of valley bottom width to active channel width	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Valley Characteristics</b>		<b>Valley Bottom Gradient</b>		<b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Valley Bottom Gradient</b>					
Sample Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	
Valley Bottom Gradient	%	Floating Point	XXX%	measured in length of about 300 m	ratio of valley bottom width (m) to active channel width
Basin Name	N/A	Variable Text	N/A	name of basin in study	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Valley Characteristics</b>		<b>Valley Bottom Containment</b>		<b>Drainage Basin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Valley Bottom Containment***

Stream Length	Meters	Floating Point	XXXX.XX	length of stream	
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	
Valley Confinement	%	Floating Point	XXX%	valley floor width / channel widths	hillslopes within 1000 horizontal meters and 100 vertical meters distance from channel
Basin Name	N/A	Variable Text	N/A	name of basin in study	
Sample Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	

<b>General Characteristic: Channel Characteristics</b>		<b>Specific Indicator Elevation</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Elevation</i></b>					
Sample Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	Site - ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	
Elevation	Meters	Floating Point	XXXXXXXX.XX	elevation at start of survey reach, determined from quad map, looking downstream	
Quad Name	N/A	Variable Text	N/A	quad name	
Quad Scale	Ft.	Variable Text	1:24000	scale of map	

<b>General Characteristic: Channel Characteristics</b>		<b>Specific Indicator Channel Type</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Channel Type</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Entrenchment Ratio	ratio	Floating Point	X.X	degree of vertical containment of river channel --- width of flood prone area at elevation twice of maximum Bankfull depth/Bankfull width	(flood prone width / Bankfull width) (flood prone width = water level @ 2 X max. depth)
Width / Depth Ratio	ratio	Floating Point	X.X	index value - indicates shape of channel cross-section	Bankfull width / mean Bankfull depth
Sinuosity		Floating Point	XX.XX	stream length / valley length	also valley slope / channel slope-- can be determined from aerial photo:
Max Depth	Meters	Floating Point	XXXX.XX	maximum depth of stream	
Bankfull Channel Width	Meters	Floating Point	XXXX.XX	depth at which the flow fills channel to top of channel banks	
Beginning Elevation	Meters	Floating Point	XXXX.XX	elevation at start of survey reach, determined from quad map	
Ending Elevation	Meters	Floating Point	XXXX.XX	elevation at end of survey reach, determined from quad map	

<b>General Characteristic: Channel Characteristics</b>		<b>Specific Indicator Channel Type</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Slope	Meters	Floating Point	XXX%	elevation difference between start and finish	averaged for 20 -30 channel widths
Stream Type	N/A	Variable Text	Aa+, A, B, C, D,	stream type according to Rosgen	see table below

<b>General Characteristic: Channel Characteristics</b>		<b>Specific Indicator Bed-Form Type</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Bed-Form Type</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	optional
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	optional
Valley Segment Type	N/A	Variable Text	N/A	colluvial, alluvial, bedrock	
Predominant Bed Type	N/A	Variable Text	variable, bedrock	dominant bed material	
Dominant Roughness elements	N/A	Variable Text	boulders, LWD, s		
Slope	%	Floating Point	XXX%	slope of valleys	
Confinement	N/A	Variable Text	strongly confined	stream confinement	
Pool Spacing	Channel widths	Variable Text	variable, <1, 1 -	spacing of pools in stream reach	
Valley Types	N/A	Variable Text	colluvial, bedroc	see table below on characteristics	

<b>General Characteristic:</b> <b>Channel Characteristics</b>		<b>Specific Indicator</b> <b>Channel Gradient</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Channel Gradient</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	optional
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	optional
Quad Name	N/A	Variable Text	N/A	quad name	optional
Quad Scale	Ft	Variable Text	1:24000	scale of map	optional
Beginning Elevation	Meters	Floating Point	XXXXXX.XX	elevation at start of survey reach, determined from quad map	Can be taken from GIS DEM data
Ending Elevation	Meters	Floating Point	XXXXXX.XX	elevation at end of survey reach, determined from quad map	Can be taken from GIS DEM data
Elevation Difference	Meters	Floating Point	XXXXXX.XX	elevation difference between start and finish	
Map Gradient	Meters	Floating Point	XXXXXX.XX	rise/run * 100	
Observed Gradient	Meters	Floating Point	XXXXXX.XX	taken every 200 and averaged, follow hand level method to determine	

<b>General Characteristic: Channel Characteristics</b>		<b>Specific Indicator Riparian Vegetation</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Riparian Vegetation</i></b>					
Sample Reach ID	N/A	Variable Text	N/A	unique reach id value given to research site	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Type	N/A	Variable Text	field work, image	method of how survey was conducted	field work or examining aerial photos
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	End date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Stream Length	Meters	Floating Point	XXXX.XX	length of stream	
Reach Length	Meters	Floating Point	XXXX.XX	length of survey reach	
Imagery Type	N/A	Variable Text	aerial photos, LA	imagery type	
Min. Vegetation	N/A	Variable Text	barren grasses or	bare minimum classification	
Tree Classifications	N/A	Variable Text	N/A	tree types appearing in imagery	
Shrub Classifications	N/A	Variable Text	N/A	shrub types appearing in imagery	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Escapement / number</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Escapement / number</i></b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Site - ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Date when count started	Use for single date count event
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Date when count ended	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Total Escapement	Count	Integer	XXXX	total number of mature adults that are in stream	
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Species Name	N/A	Variable Text	N/A	spring Chinook, summer / fall Chinook, steelhead, sockeye salmon, bull trout, cutthroat trout	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	
Collection Method	N/A	Variable Text	N/A	collection method	snorkeling being the preferred method

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Age Structure</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Age Structure</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Site - ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Weir Location	Lat/Long	Floating Point	Decimal Degrees	location of weirs	
Weir ID	N/A	Variable Text	N/A	unique site id value given to weir	
Weir / Trap type	N/A	Variable Text	N/A	description of wire or trap type	
Age	months, years	Integer	N/A	age of fish as determined from age analysis of fish scales	
Species	N/A	Variable Text	anadromous, resi	Chinook, steehead, sockeye----- resident = bull trout, cutthroat trout	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Size</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Size</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Species	N/A	Variable Text	anadromous, resi	anadromous = spring Chinook, summer / fall Chinook, steelhead, sockeye ----- resident = bull trout, cutthroat trout	
Collection Method	N/A	Variable Text	N/A	collection method	snorkeling being the preferred method
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Weir Location	Lat/Long	Floating Point	Decimal Degrees	location of weirs	
Weir ID	N/A	Variable Text	N/A	unique site id value given to research site	
Weir / Trap type	N/A	Variable Text	N/A	description of wire or trap type	
Size	nearest mm	Floating Point	XXX.XX	reported as fork length (anterior tip to median caudal fin) and hypural length (mid-eye to hypural plate)	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	

<b>General Characteristic:</b> <b>Adults</b>		<b>Specific Indicator</b> <b>Size</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Sex Ratio</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Sex Ratio</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Species	N/A	Variable Text	anadromous, resi	anadromous = spring Chinook, summer / fall Chinook, steelhead, sockeye ----- resident = bull trout, cutthroat trout	
Collection Method	N/A	Variable Text	N/A	collection method	snorkeling being the preferred method
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Weir Location	Lat/Long	Floating Point	Decimal Degrees	location of weirs	
Weir ID	N/A	Variable Text	N/A	unique site id value given to research site	
Weir / Trap type	N/A	Variable Text	N/A	description of wire or trap type	
Sex Ratio	Count	Ratio	N/A	males / females	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Sex Ratio</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Origin (Hatchery or Wild)</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Origin (Hatchery or Wild)</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Species Type	N/A	Variable Text	anadromous, resi	anadromous = spring Chinook, summer / fall Chinook, steelhead, sockeye ----- resident = bull trout, cutthroat trout	
Collection Method	N/A	Variable Text	N/A	collection method	snorkeling being the preferred method
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Weir Location	Lat/Long	Floating Point	Decimal Degrees	location of weirs	
Weir ID	N/A	Variable Text	N/A	unique site id value given to research site	
Weir / Trap type	N/A	Variable Text	N/A	description of wire or trap type	
Aidpose Present?	N/A	Boolean	yes/no	is the adipose fin present?	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Origin (Hatchery or Wild)</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Genetics</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Genetics</b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Species	N/A	Variable Text	anadromous, resi	anadromous = spring Chinook, summer / fall Chinook, steelhead, sockeye ----- resident = bull trout, cutthroat trout	
Collection Method	N/A	Variable Text	N/A	collection method	snorkeling being the preferred method
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Weir Location	Lat/Long	Floating Point	Decimal Degrees	location of weirs	
Weir ID	N/A	Variable Text	N/A	unique site id value given to research site	
Weir / Trap type	N/A	Variable Text	N/A	description of wire or trap type	
Number of Collection Sites	number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	

<b>General Characteristic:</b> <b>Adults</b>		<b>Specific Indicator</b> <b>Genetics</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Within Population Genetics	N/A	Variable Text	N/A	genetic variability within population	
Between Population Genetics	N/A	Variable Text	N/A	genetic variability between populations	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Fecundity</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Fecundity</i></b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Species	N/A	Variable Text	anadromous, resi	anadromous = spring Chinook, summer / fall Chinook, steelhead, sockeye ----- resident = bull trout, cutthroat trout	
Collection Method	N/A	Variable Text	N/A	collection method	snorkeling being the preferred method
Spawning Escapement	Count	Integer	XXXX	number of adults that spawn in stream	
Weir Location	Lat/Long	Floating Point	Decimal Degrees	location of weirs	
Weir ID	N/A	Variable Text	N/A	unique site id value given to research site	
Weir / Trap type	N/A	Variable Text	N/A	description of wire or trap type	
Hatchery Name	N/A	Variable Text	N/A	name of hatchery	
Fecundity	Count	Integer	XXXX	total number of eggs produced by a given size female	estimated from fish collected for hatchery brood stock and from dead pre-spawn females

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Adults</b>		<b>Fecundity</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Hatchery ID	N/A	Variable Text	N/A	unique hatchery id value given to research site	

<b>General Characteristic: Redds</b>		<b>Specific Indicator Number</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Number</b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Reach Section	N/A	Variable Text	N/A	unique id for reach section	optional
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	optional
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Survey Type	N/A	Variable Text	field work, image	type of survey; aerial, foot, other	
Miles Surveyed	miles	Integer	XXX	total number of miles surveyed for each section	
Size of Redds	Count	Integer	XXXX	Count of redds by size class	
Number of Redds	Count	Integer	XXXX	number of redds (nests) in subbasin	
Flow Conditions	N/A	Variable Text	N/A	flow description change from original flow sample taken	exp. Rained night before - increased flow, tree fell in stream - increased sediment

<b>General Characteristic:</b> <b>Redds</b>		<b>Specific Indicator</b> <b>Number</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Visibility	%	Floating Point	XXX%	percent visibility of diver	
Total Number	Number	Integer	N/A	total number from collections per kilometer	

<b>General Characteristic:</b> <b>Redds</b>		<b>Specific Indicator</b> <b>Distribution</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Distribution</i></b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Reach Section	N/A	Variable Text	N/A	unique id for reach section	optional
Number of Redds	Count	Integer	XXXX	number of redds (nests) in subbasin	optional
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	optional
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Total Number	Number	Integer	N/A	total number from collections	
Species Type	N/A	Variable Text	N/A	what type of fish	
Spatial Distribution	N/A	Variable Text	N/A	where in subbasin do certain species appear	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Parr / Juveniles</b>		<b>Abundance / Distribution</b>		<b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Abundance / Distribution***

Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	optional
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Collection Method	N/A	Variable Text	N/A	collection method	
Time of Collection	Time	Variable Text	day or night	provides best estimate of juvenile fish	
Species	N/A	Variable Text	N/A	species of fish	
Fish Abundance	Fish / ha	Integer	XXXX	number of fish counted	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b> <b>Parr / Juveniles</b>		<b>Specific Indicator</b> <b>Size_parr</b>		<b>Domain</b> <b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Size_parr</b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Collection Method	N/A	Variable Text	N/A	collection method	
Time of Collection	Time	Variable Text	day or night	provides best estimate of juvenile fish	
Species	N/A	Variable Text	N/A	species of fish	
Size	CM	Floating Point	XXX.XX	estimated size of fish	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Smolts</b>		<b>Number_smolts</b>		<b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Number_smolts</b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Trapping Method	N/A	Variable Text	N/A	Method used for fish trapping	
Trapping Duration	Time	Floating Point	Minute	Days, hours, minutes for trapping duration	
Time of Collection	Time	Variable Text	day or night	provides best estimate of juvenile fish	
Trapping Efficiency	ratio	Floating Point	mark / recapture	based on the mark / recapture estimate	
Efficiency Test Frequency	N/A	Variable Text	hourly, daily, we	frequency that efficiency tests are conducted	

<b>General Characteristic:</b> <b>Smolts</b>		<b>Specific Indicator</b> <b>Number_smolts</b>		<b>Domain</b> <b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Number of smolts	ratio	Floating Point	XXXX.XX	# of smolts per population or subpopulation	
Origin	N/A	Limited List	List of Origin Op	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Smolts</b>		<b>Size_smolts</b>		<b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Size_smolts</b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	optional
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Trapping Method	N/A	Variable Text	N/A	Method used for fish trapping	
Trapping Duration	Time	Floating Point	Minute	Days, Hours, minutes for trapping duration	
Time of Collection	Time	Variable Text	day or night	provides best estimate of juvenile fish	
Trapping Efficiency	ratio	Floating Point	mark / recapture	based on the mark / recapture estimate	
Efficiency Test Frequency	N/A	Variable Text	hourly, daily, we	frequency that efficiency tests are conducted	

<b>General Characteristic:</b> <b>Smolts</b>		<b>Specific Indicator</b> <b>Size_smolts</b>		<b>Domain</b> <b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Species	N/A	Variable Text	N/A	species of fish	
Size	MM	Floating Point	XXX.XX	fork length	
Origin	N/A	Limited List	N/A	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b> <b>Smolts</b>		<b>Specific Indicator</b> <b>Genetics_smolts</b>		<b>Domain</b> <b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Genetics_smolts</b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Subbasin Name	N/A	Variable Text	N/A	name of subbasin	optional
Subbasin ID	N/A	Variable Text	N/A	unique subbasin id value given to research site	optional
Number of Collection Sites	Number	Integer	XXXX	number of collection sites	
Collection Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Trapping Method	N/A	Variable Text	N/A	Method used for fish trapping	
Trapping Duration	Time	Floating Point	Minute	Days, Hours, minutes for trapping duration	
Time of Collection	Time	Variable Text	day or night	provides best estimate of juvenile fish	
Trapping Efficiency	ratio	Floating Point	mark / recapture	based on the mark / recapture estimate	
Efficiency Test Frequency	N/A	Variable Text	hourly, daily, we	frequency that efficiency tests are conducted	

<b>General Characteristic:</b> <b>Smolts</b>		<b>Specific Indicator</b> <b>Genetics_smolts</b>		<b>Domain</b> <b>Subbasin</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Within Population Genetics	N/A	Variable Text	N/A	genetic variability within populations	
Between Population Genetics	N/A	Variable Text	N/A	genetic variability between populations	
Origin	N/A	Limited List	N/A	Wild, Hatchery, Other	
Origin Method	N/A	Variable Text	N/A	Description of how origin is determined	

<b>General Characteristic:</b> <b>Macroinvertebrates</b>		<b>Specific Indicator</b> <b>Transport</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Transport</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Sample_ID	N/A	Variable Text	N/A	Unique ID assigned to each invertebrate sample	Used to link to taxonomic results
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	optional
Wetted Width	Meters	Floating Point	XXX.X	average width of stream through selected reach	optional
Map Gradient	%	Floating Point	XXX.XX	rise over run * 100, calculated from 7.5 topo	optional
Stream Length	Meters	Floating Point	XXX.XX	length of stream reach	
Temperature	Degrees C	Floating Point	0.1 C	Recorded Temperature level	Repeated through the deployment period for each time step
Discharge Beginning	Seconds	Time	60 seconds	determined by recording time taken to fill known container	Recorded at the beginning and end of the sampling period
Discharge Volume	Volume units, M	Floating Point	XX.X	Volume of container for measuring flow rates	Recorded at the beginning and end of the sampling period
Discharge End	Seconds	Time	60 seconds	determined by recording rime taken to fill known volume container	Recorded at the beginning and end of the sampling period

<b>General Characteristic:</b> <b>Macroinvertebrates</b>		<b>Specific Indicator</b> <b>Transport</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Discharge Mean	Seconds	Time	60 seconds	mean of beginning and end times	Recorded at the beginning and end of the sampling period
Discharge Percent	%	Percent	XX.X%	Estimated percent of flow measured for volume	Not necessary if entire flow is diverted by sampler
Sample Frequency	N/A	Variable Text	hourly, daily, we	helps create an averaged value for a 24 hr period	
Sample Percent	%	percent	XX.X%	Estimate detritus as percent of total sample	
Invert Percent	%	percent	XX.X%	Estimate of invertebrates as a percent of total sample	

<b>General Characteristic:</b> <b>Macroinvertebrates</b>		<b>Specific Indicator</b> <b>Composition</b>		<b>Domain</b> <b>Reach-wide Sample</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Composition</b>					
Site ID	N/A	Variable Text	N/A	Sample ID for reach-wide composite sample	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Sample ID	N/A	Variable Text	N/A	Unique Sample ID	Sample ID for composite sample
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Sample_Type	N/A	Limited List	N/A	Type of sample	Reach-Wide, Targeted Riffle
Container Count	Number of sampl	Integer	XX.X	Number of containers needed to hold sample	
Sample Volume	Volume Units, M	floating Point	XX.X	Volume of composite sample	
RW Sample Point	N/A	Limited List	Left, Center, Rig	Defines sample location on transect	Repeated for each 11 transects
RW Sample Channel	N/A	Limited List	Pool, Glide, Riffle	Channel type for the sample point	Repeated for each 11 transects
RW Substrate	N/A	Limited List	Fine / Sand, Grav	Substrate type for the sample point	Repeated for each 11 transects
TR_Sample1 nearest transect	N/A	Limited List	N/A	Nearest of the 11 site transects	This is repeated for each of the 8 targeted riffle transects
TR_Sample1 Substrate	N/A	Limited List	N/A	Fine Sand - Pool; Gravel - Glide; Coarse - Riffle; Other - Note - Rapid;	Same classes as are used with the reach-width samples
TR_Sample1 Size	N/A	Limited List	FS, G, C, O	Size classes of substrate	

<b>General Characteristic:</b> <b>Macroinvertebrates</b>		<b>Specific Indicator</b> <b>Composition</b>		<b>Domain</b> <b>Targeted Riffle Sampl</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
TR_Sample Quad	N/A	Limited List	N/A	Sampled quadrant from 3 x 3 grid Lower right; Lower center; Lower left; Right center; Center; Left center; Upper right; Upper center; Upper left.	
Sample Date	Day, Month, Yea	Date Time	N/A	Sample collection date	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>MWMT/MDMT</b>		<b>Domain</b> <b>Logger Manufacture</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>MWMT/MDMT</b>					
Logger model number	N/A	Variable Text	N/A	Data logger model number	
Logger ID	N/A	Variable Text	N/A	Unique ID assigned to each logger	
Manufacturer	N/A	Variable Text	N/A	Name of data logger manufacturer	
Manufacturer Support Phone	N/A	Variable Text	N/A	manufacturer phone number for technical support	
Manufacture support email	N/A	Variable Text	N/A	Manufacturer email for technical support	
Manufacturer Web Site	N/A	Variable Text	N/A	Manufacturer Web site URL	
Manufacturer Address	N/A	Variable Text	N/A	Manufacturer Address	
Purchase data	Calendar Day	Date	dd/mm/yyyy	Date logger was purchased	
Measurement Range Low	Degrees C	Floating Point	0.1 C	Minimum temperature measurement provided based upon manufactures specifications.	
Measurement Range High	Degrees C	Floating Point	0.1 C	Minimum temperature measurement provided based upon manufacturers specifications	
Measurement Interval	Time, Minutes	Integer	Minute	measurement time interval used for calibration and use	
Calibration start	Date and Time	Date Time	dd/mm/yyyy hou	Date and time calibration run started	
Calibration end	Date and Time	Date Time	dd/mm/yyyy hou	Date and time calibration run completed	
Measurement units	Degrees C	Floating Point	0.1 C	minimum measurement unit	
Battery date	Date and Time	Date	dd/mm/yyyy	Date that the current battery is installed	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>MWMT/MDMT</b>		<b>Domain</b> <b>Calibration</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Clock Test Set	Time, Minutes	Integer	Minute	Time interval setting in minutes for calibration test	
Clock test measure	Time, Minutes	Integer	Minute	Average time interval measurement during calibration test.	
Measure Time	Date and Time	Date Time	dd/mm/yyyy hou	Date and time of reading during the calibration test	Repeated through the range of expected temperatures
Test temperature	Degrees C	Floating Point	0.1 C	Certified (NIST) laboratory thermometer measurement of test bath	Repeated through the range of expected temperatures
Logger temperature	Degrees C	Floating Point	0.1 C	Logger temperature reading.	Repeated through the range of expected temperatures
Project Code	N/A	Variable Text	N/A	Project code used for linking to project information	
SampSite_ID	N/A	Variable Text	N/A	Sample site identify	
Logger ID	N/A	Variable Text	N/A	Data logger unique ID code or number. Can be assigned by researcher or be the manufacturer serial number	the logger id must be permanently and clearly shown on each data logger
Logger Deployment	N/A	Memo/Comment	N/A	Description of logger deployment approach and conditions	
Deployment Start	Date and Time	Date Time	dd/mm/yyyy hou	Start time for deployment	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Deployment End	Date and Time	Date Time	dd/mm/yyyy hou	End time for deployment	
Field Interval	Integer	Minute	Time interval sett	Time interval setting in minutes during field deployment	
MDMT	Degrees C	Floating Point	Maximum daily		
MDMT Start	Date and Time	Date Time	dd/mm/yyyy hou	Beginning date for MDMT measurement	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>MWMT/MDMT</b>		<b>Domain</b> <b>Field</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
MDMT End	Date and Time	Date Time	dd/mm/yyyy hou	Ending date for MDMT measurement	
MWMT	Degrees C	Floating Point	Maximum weekl		
MWMT Start	Date and Time	Date Time	dd/mm/yyyy hou	Beginning date for MWMT measurement	
MWMT Start	Date and Time	Date Time	dd/mm/yyyy hou	Ending date for MwMT measurement	
Time	Date and Time	Date Time	dd/mm/yyyy hou	Data and time of each temperature recores	Repeated through the deployment period for each time step
Temperature	Degrees C	Floating Point	0.1 C	Recorded Temperature level	Repeated through the deployment period for each time step

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>Turbidity</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Turbidity***

Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Activity	N/A	Variable Text	N/A	description of activity that the turbidity is being measured for	only is measuring for a certain activity-if collecting baseline turbidity data - don't use
Sample Frequency	Time	Variable Text	hourly, daily, we	time measurement	must be long enough time period to capture range of flow conditions and turbidity generating activities
Sample ID	Number	Integer	1,2,3,4,5 etc.	Unique Sample ID	must be large enough sample to capture range of flow conditions and turbidity generating activities
Flow Conditions	N/A	Variable Text	N/A	flow description change from original flow sample taken	exp. Rained night before-increase flow-tree fell in stream-increased sediment
Turbidity Measurement	NTU	Floating Point	XXX.X	measurement taken with turbidimeter	
Weather	N/A	Variable Text	N/A	description of weather at time of sample	
Time of Measurement	Time	Date Time	N/A	exp. 01/01/04	
Stream Depth	Meters	Floating Point	XX.XX	depth of stream and measurement p	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>Turbidity</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Sample Location	Decimal Degrees	Floating Point	Seconds, 1.0000x	location of sample - get from topo maps, gps unit	optional sub sample site location

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>Conductivity</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Conductivity</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample Location	Lat/Long	Floating Point	Decimal Degrees	location of sample - get from topo maps, gps unit	
Time	Date and time	Date Time	dd/mm/yyyy	Date and time of temperature	Repeated through the deployment period for each time step
Temperature	Degrees C	Floating Point	0.1 C	Recorded Temperature level	Repeated through the deployment period for each time step
Water Type	N/A	Variable Text	fresh/salt	fresh water-lake / salt water-ocean etc.	
Flow Conditions	N/A	Variable Text	runoff, standing	water flow conditions	
Calibration Conductivity	mhos/cm	Integer		conductivity amount of sample-DEQ recommends standard solution for fresh surface water measurements of potassium chloride (KCl) with conductivity of 147 mmhos/cm	
Relative Percent Difference (RPD)	%	Percent	XX.XX	should be within 7% for data quality A, 10% for B	if RPD is greater - repeat accuracy test
Sample Conductivity	mhos/cm	Integer			

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>Conductivity</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Sample ID	Number	Integer	1,2,3,4,5 etc.	Unique Sample ID	optional sub sample site location

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>pH</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>pH</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample Location	Lat/Long	Floating Point	Decimal Degrees	location of sample - get from topo maps, gps unit	
Time of day	Time	time	10:15 am	helps to establish a base acidic leve	water naturally more acidic during the night - lowest right before sunris
Percent of Vegetation in Stream	%	Floating Point	XXX%	more plants - higher acidic rates	
Visible runoff from nearby man-made f	N/A	Boolean	yes/no	exp. Urban runoff, industrial discharges, agricultural	introduces fertilizers into water
Temperature	Degrees C	Floating Point	0.1 C	Recorded Temperature level	Repeated through the deployment period for each time step
Calibration Test	ph	Integer	0 - 14	calibration reading for ph meter	
Calibration test time	clock time	time	10:15 am	time of calibration test	
Buffer Solution	ph level	Integer	7 and 10	solution used to help calibrate ph meter	every ten samples
ph level	ph level	Floating Point	XX.XX	ph level of water	
Sample ID	Number	Integer	1,2,3,4,5 etc.	Unique Sample ID	optional sub sample site location

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>DO (dissolved oxygen)</b>		<b>Domain</b> <b>Sample Site</b>	
Attribute	Units	Data Type	Precision	Description	Comment
<b>DO (dissolved oxygen)</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample Location	Lat/Long	Floating Point	Decimal Degrees	location of sample- get from topo maps, gps unit	
Time of day	Time	Time	10:15 am	helps to establish base level	water naturally more acidic during the night - lowest right before sunris
DO	ppm (parts per mi	Floating Point	XX.XX	amount of dissolved oxygen (DO Saturation)	holds more dissolved water at low temps- salmonid supporting water necessary DO levels are from 11 mg/l in spawning to 6 mg/l in non-spawning waters
Sample ID	Number	Integer	1,2,3,4,5 etc.	Unique Sample ID	optional sub sample site location
Intergrate DO	ppm (parts per mi	Floating Point	XX.XX	amount of dissolved oxygen (DO saturation)	collected by pumping a water sample from gravel
Sample Frequency	N/A	Variable Text	hourly, daily, we	frequency of samples taken- based on goal want to achieve	
Titration method	N/A	Variable Text	hach digital filtrat	titration method for determining mg/l	
Water Temperature	Celcius	Floating Point	XX.X	water temperature at time of sample	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>DO (dissolved oxygen)</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Elevation	Feet	Integer	XXXXXX.XX	elevation	
DO 100% Saturation	%	Floating Point	XX.XX	saturation point at certain temperatures - values according to table	
Elevation Factor	Number	Floating Point	X.XX	multiplication factor for determining atmospheric pressure	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>Nitrogen/Phosphorus</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Nitrogen/Phosphorus</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample Location	Lat/Long	Floating Point	Decimal Degrees	location of sample- get from topo maps, gps unit	optional sub sample site location
Percent of Vegetation in Stream	%	Floating Point	XXX%	more plants - higher acidic rate	
Visible Runoff from nearby man-made	N/A	Boolean	yes/no	exp. Urban runoff, industrial discharges, agricultural	introduces fertilizers into water
Water Temperature	Celcius	Floating Point	XX.X	water temperature at time of sample	
Velocity	M/S	Integer	X.XX	value from rod	electromagnetic current meter- lowest time constant scale, impeller type meter-mid position, "display averaging"
Sample ID	Number	Integer	1,2,3,4,5 etc.	Unique Sample ID	large enough sample to form base measurement
Chemical Levels				level of chemicals present in water sample	
Chemical Type	N/A	Variable Text	Nitrate/Nitrite- K	chemical present in water sample	

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>FLIR / Temp</b>		<b>Domain</b> <b>Stream Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>FLIR / Temp</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	Name	Variable Text	N/A	Name of stream	
Contractor	Name	Variable Text	N/A	Name of contractor or agency who acquire the imagery	
Primary Objective		Fixed Text	N/A	Primary objective of the study	could be "temperature general", "tmdl/modeling", thermal refugia", etc.
Start Map Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey, can be spatial
Start Map Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey, can be spatial
Start GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey, can be spatial
Start GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey, can be spatial
End GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of end of survey, can be spatial

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>FLIR / Temp</b>		<b>Domain</b> <b>Stream Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
End GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of end of survey, can be spatial
Survey Length	Meters	Integer	XXXX	survey length	can be spatial
Stream Elevation	Meters	Integer	exp. 300 - 650 m	beginning elevation pt to ending elevation pt	can be spatial
Air Temperature	Celsius	Floating Point	XXX.XX	Average air temperature during time frame	collected from local airports and various U.S National Weather Service stations, Multiple stations can be used
Relative Humidity	r.h.	Floating Point	XXX.XX	Average air temperature during time frame of the survey relative humidity	collected from local airports and various U.S National Weather Service stations, Multiple stations can be used
Cloud Cover %	%	Floating Point	XXX%	percentage cloud cover during time frame of survey	
Surface Winds	Miles Per Hour	Floating Point	XXX mph	surface winds / miles per hour	gathered from local weather surface
Spatial Resolution	N/A	Floating Point	0.2 - 0.4 Meters e	Pixel resolution of the TIR imagery	
Sensor Wavelength	µm wavebands	Integer	3 - 5 and 8 - 14 µ	water temp emitted from upper 0.1 mm of water	
Ground Footprint	Meters	Integer	XXXX	Average ground width of the imagery. Defines spatial scale.	based on contractor/sensor combination of sensor field of view and flight altitude
Kinetic Measurement	Number	Integer	XX	The number of in-stream data loggers withing the TIR survey reach used to verify accuracy	Can be supported using temperature protocol
Thermal Accuracy	Celcius	Floating Point	X.XX	Average absolute difference between the TIR data and kinetic temperature	
Acquisition Time	Time of day	Time	14:35:02 pm	Time the images were taken	By image

<b>General Characteristic:</b> <b>Water Quality</b>		<b>Specific Indicator</b> <b>FLIR / Temp</b>		<b>Domain</b> <b>FLIR Image</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Acquisition Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	geographic coordinate information from images	By image, can be spatial
Acquisition Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	geographic coordinate information from images	By image, can be spatial
Sample Median of Tributary-Thalweg	Celcius	Floating Point	X.XX	calculated median radiant temperature from sample points taken from the stream thalweg in each image	By image
Tributary Name	N/A	Variable Text	N/A	name of tributary or other inflow if present in the image	By image, can be spatial
Sample Median of Tributary - Images	Celsius	Floating Point	X.XX	calculated median radiant from sample points taken from the tributary mouth-would not be present on all images	By image

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Habitat Access</b>		<b>Road Crossing</b>		<b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Road Crossing***

Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Culvert ID	N/A	Integer	X.X	if only one culvert value is 1.1, if two or more. value would be 1.2 and so on	
Culvert Shape	N/A	Variable Text	N/A	shape of culvert under road	round, box, bottomless, squash, elliptical, other

<b>General Characteristic:</b> <b>Habitat Access</b>		<b>Specific Indicator</b> <b>Road Crossing</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Culvert Material	N/A	Variable Text	N/A	material of culvert- PCC, CPC, CST, SST, CAL, SPS, SPA, PVC, TMB, MRY,	see table below for values CPC- cast in place concrete CST- corrugated steel SST- smooth steel CAL- corrugated aluminum SPS- structural plate steel SPA- structural plate aluminum PVC- polyvinylchloride TMB- timber MRY- masonry OTH- other#see table below for values CPC- cast in place concrete CST- corrugated steel SST- smooth steel CAL- corrugated aluminum SPS- structural plate steel SPA- structural plate aluminum PVC- polyvinylchloride TMB- timber MRY- masonry OTH- other#
Culvert Span/Diameter	Meters	Floating Point	XX.XX	max width of culvert	
Culvert Height	Meters	Floating Point	XX.XX	max height of culvert	
Water Depth in Culvert	Meters	Floating Point	XX.XX	water depth inside culvert	
Water Drop	Meters	Floating Point	XX.XX	measurement from water surface in culvert to water surface after drop	
Culvert Length	Meters	Floating Point	XXX.XX	length of culvert	
Slope	Meters	Floating Point	XX.XX	slope of culvert	use laser or derive from topo info
Streambed material	N/A	Boolean	yes/no	is there streambed material throughout culvert	
Velocity	Meters/Second	Integer	X.XX	value from road	electromagnetic current meter- lowest time constant scale, impeller type meter-mid position, "display averaging"

<b>General Characteristic:</b> <b>Habitat Access</b>		<b>Specific Indicator</b> <b>Road Crossing</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Culvert Apron	N/A	Variable Text	yes/no	is there an apron attached to end of culvert?	
Plunge Pool Max Depth	Meters	Floating Point	XX.XX	max depth of plunge pool	
Plunge Pool Length	Meters	Floating Point	XXX.XX	length of plunge pool	
Ordinary High Water Width	Meters	Floating Point	XXX.XX	level of high water under normal circumstances-width of pool at this measurement	
Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	

<b>General Characteristic:</b> <b>Habitat Access</b>		<b>Specific Indicator</b> <b>Diversion Dams</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Diversion Dams***

Flag	N/A	Variable Text	N/A	Comments	
Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer-person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample Location	Lat/Long	Floating Point	Decimal Degrees	location of sample - get from topo maps, gps unit	
Dam Name	N/A	Variable Text	N/A	name of dam or nearest landmark	
Reservoir Name	N/A	Boolean	N/A	name of reservoir or nearest landmark	

<b>General Characteristic:</b> <b>Habitat Access</b>		<b>Specific Indicator</b> <b>Diversion Dams</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Dam Type	N/A	Variable Text	CN, RE, MS, M	what the dam is built of	RE- earthfill MS- masonry MT- metal ER- rockfill TB- timer OT- ther# RE- earthfill MS- masonry MT- metal ER- rockfill TB- timer OT- ther#
Span	N/A	Variable Text	full/partial	does dam completely or partially span channel	
Length	Meters	Floating Point	XXX.XX	length of dam	
Height	Meters	Floating Point	XXX.XX	height of dam	
Overflow Present	N/A	Variable Text	yes/no	is there water overflowing over the dam	
Surface Difference	Meters	Floating Point	XX.XX	difference between water surface before dam and water surface after dam	
Dam Plunge Pool Depth	Meters	Floating Point	XX.XX	depth of dam plunge pool	
Dam function	N/A	Variable Text	D, C, H, I, N. P.	what is the dams function?	see chart below
Barrier	N/A	Variable Text	yes/no/unknown	fish passage evaluation	if stream doesn't carry fish- leave blank

<b>General Characteristic:</b> <b>Habitat Access</b>		<b>Specific Indicator</b> <b>Fishways</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Fishways</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample Location	Lat/Long	Floating Point	Decimal Degrees	location of sample - get from topo maps, gps unit	
Fishway Type	N/A	Variable Text	BC, BF, BL, LC,	type of fishway	see table below for values
Fishway Modifications	N/A	Variable Text	N/A	structure that the fishway modified for fish passage	
Construction Year	year	Date Time	year	year fishway was constructed	if unknown leave blank
Number of Pools	Number	Integer	1,2,3,4,5 etc.	number of pools in the in the fishway	
Entrance Pool Depth	Meters	Floating Point	XX.XX	depth of entrance pool	
Pool Head ID	N/A	Integer	1,2,3,4,5 etc.	unique id number for each pool difference	pool 1 to pool 2 = 1, pool 2 to pool 3 = 2.....
Pool Head Difference	Meters	Floating Point	XX.XX	difference between water surfaces between each pool	
Baffle Number	Number	Integer	XXX	number of baffles in baffled culvert	

<b>General Characteristic:</b> <b>Habitat Access</b>		<b>Specific Indicator</b> <b>Fishways</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Baffle Material	N/A	Variable Text	Concrete, Rock,	material out of which the baffles are made	
Number of Weirs	Number	Integer	1,2,3,4,5 etc.	number of weirs present in fishway	
Weir Type	N/A	Variable Text	Concrete, Rock,	material out of which the weir is constructed out of	
Grade control	N/A	Variable Text	none, upstream, d	presence of streambed grade control factors	
Description	N/A	Variable Text	N/A	description of fishway and immediate surroundings	
Photos Taken	N/A	Variable Text	yes/no	photos of diversion for documentation	
Flag	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>Dominant Substrate</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Dominant Substrate</b>					
Sample Type	N/A	Variable Text	N/A	sample described as reach-wide benthos, or targeted riffle sample	type of method used to collect sample
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
No. of Jars	Number	Integer	N/A	# of sampling containers used	
Transect	N/A	Variable Text	one letter exp. A,	transect identifier	
Sampling Point	N/A	Variable Text	N/A	assigned sampling point of Left-Center-Right	Right center channel substrate code 75% of transect position
Habitat Type	N/A	Variable Text	N/A	habitat type- value of riffle / run or pool / glide	not sufficient current - defined as pool / glide
Substrate Type	N/A	Variable Text	N/A	defined as fine / sand - gravel - coarse - other	dominant substrate type - note others in comm.
Channel Type	N/A	Variable Text	N/A	defined as pool - glide - riffle - rapi	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>Embeddedness</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Embeddedness</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	
Sample Type	N/A	Variable Text	N/A	sample described as reach-wide benthos, or targeted riffle sample	type of method used to collect sample
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Channel Location	N/A	Variable Text	N/A	measured as Left, LCtr, Ctr, RCtr, Right	
Distance Left Bank	Meters	Floating Point	XX.XX	distance from left bank at each cross-section	
Depth	CM	Floating Point	XX.X	measured depth at each cross-section	measured only at regular transects A K
Size Class Code	N/A	Variable Text	N/A	use provided codes	
Embeddedness	percentage	Integer	XXX%	estimate average % embeddedness in 10 cm circle	Sand and fines are embedded 100%; bedrock and hardpan embedded 0 percent
Flag	N/A	F1, F2	N/A	data reviewer - person verifying the data comments	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>Depth Fines</b>		<b>Domain</b> <b>Transect Observation</b>	
Attribute	Units	Data Type	Precision	Description	Comment
<b>Depth Fines</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Segment ID	N/A	Variable Text	N/A	unique id value given to research sample	sub-selection
Sample Method	N/A	Variable Text	Riffle crest, Grav	sampling method type	
Reference Points #	N/A	Variable Text	N/A	landmarks along stream reach	
Sample #	N/A	Variable Text	N/A	unique id-sample point	12 samples - riffle crest-gravel patch
Distance from O	Meters	Floating Point	XX.XX	distance of Riffle from landmark O	
Channel Location	N/A	Variable Text	left bank, center,	location in stream where sample was taken	
Measurement #	N/A	Integer	1,2,3,4,5 etc.	one sample per meter width of stream--3 max	riffle only
Gravel Size	MM	Integer	8-16mm, 8-64m	three categories	
Sample Distance from LB-RC	Meters	Floating Point	width of wetted st	sample location within riffle	
Sample Distance from LB-GP	Meters	Floating Point	width of wetted st	sample location within gravel patch	
Flag	N/A	Variable Text	N/A	Comments	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>LWD (pieces/km)</b>		<b>Domain</b> <b>Transect Observation</b>	
Attribute	Units	Data Type	Precision	Description	Comment
<b>LWD (pieces/km)</b>					
Water Body Name	N/A	Variable Text	N/A	water body name	
Forested Situation	N/A	Boolean	yes/no	is the site forested	
LWD Tally	N/A	Integer	1,2,3,4,5 etc.	# of LWD in Bankfull channel that are greater than ten centimeters in diameter and at least one meter in length	less than 100 pieces, count individual, more than 100 pieces count by tens
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Sample ID	N/A	Variable Text	N/A	unique id value given to research sample	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>Pools Per Kilometer</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Pools Per Kilometer</i></b>					
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Reach Type	N/A	Variable Text	A,B,C	map gradient A = more than 4.0, B = 1.5 - 4.0, C = less than 1.5	determined from topo maps
Map Name	N/A	Variable Text	N/A	name of map that information was derived from	
Veg Cover	N/A	Variable Text	wooded, meadow	helps determine whether outside forces (wooded) help establish pool	
Valley Confinement	N/A	Variable Text	confined, modera	compare valley confinement descriptions to field observations	
Channel Code	N/A	Variable Text	M, S, A	M = main channel, S = side channel, A = adjacent habitat unit	
Pools per Kilometer	N/A	Integer	1,2,3,4,5 etc.	number of pools per kilometer	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>Pool Quality</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Pool Quality***

Reach ID	river km	Integer	exp. 267 km of ri	beginning and ending river kilometer values	
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	name of stream being studied	
Reach Type	N/A	Variable Text	A,B,C	map gradient A = more than 4.0, B = 1.5 - 4.0, C = less than 1.5	
Map Name	N/A	Variable Text	N/A	name of map that information was derived from	
Veg Cover Type	N/A	Variable Text	N/A	anything that helps conceal or protect fish from competitors or predators	
Valley Confinement	N/A	Variable Text	confined, modera	compare valley confinement descriptions to field observations	
Channel Code	N/A	Variable Text	M, S, A	M = main channel, S = side channel, A = adjacent habitat unit	
Pool Size Diameter	Meters	Floating Point	XXXX.XX	diameter of pool	
Pool Size Depth	Meters	Floating Point	XXX.XX	depth of pool	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>Habitat Quality</b>		<b>Pool Quality</b>		<b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
% Coverage	%	Floating Point	XXX%	percentage of vegetation coverage	

<b>General Characteristic: Habitat Quality</b>		<b>Specific Indicator Off Channel Habitat</b>		<b>Domain Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Off Channel Habitat</b>					
Pools Per Kilometer	N/A	Integer	1,2,3,4,5 etc.	number of pools per kilometer	
Channel Width Per Pool	N/A	Floating Point	XXXXXX.XX	length of surveyed reach (m) / Average Bankfull width (m)	
Bankfull Channel Width	Meters	Floating Point	XXXXXX.XX	width of stream at normal high water	
LWD Tally	N/A	Integer	1,2,3,4,5 etc.	# of LWD in Bankfull channel that are greater than ten centimeters in diameter and at least one meter in length	less than 100 pieces, count individual, more than 100 pieces count by tens
Wood Covered Pools	%	Floating Point	XXX.XX	percentage of pools with wood cover	(number of pools wood / total number of pools) * 100(number of pools wood / total number of pools)
Substrate Type	N/A	Variable Text	N/A	defined as fine/sand - gravel - coarse - other	dominant substrate type - note others in comm.
Percent Substrate Fine / Sand	%	Floating Point	XXX.XX%	percentage of occurrence of Fine / Sand	
Percent Substrate Gravel	%	Floating Point	XXX.XX%	percentage of occurrence of gravel	
Percentage Substrate Coarse	%	Floating Point	XXX.XX%	percentage of occurrence of coarse	
Percentage Substrate Other	%	Floating Point	XXX.XX%	percentage of occurrence of other	
Habitat Units / Spawning Gravel	%	Floating Point	XXX.XX%	percentage of habitat units with spawning gravel	
Reach ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	

<b>General Characteristic:</b> <b>Habitat Quality</b>		<b>Specific Indicator</b> <b>Off Channel Habitat</b>		<b>Domain</b> <b>Survey Reach</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Reviewer	N/A	Variable Text	N/A	data reviewer-person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Stream Name	N/A	Variable Text	N/A	stream name	
Canopy Cover Lft	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream
Canopy Cover Rgt	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream

<b>General Characteristic:</b> <b>Channel Condition</b>		<b>Specific Indicator</b> <b>Width/Depth Ratio</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### **Width/Depth Ratio**

Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Transect	N/A	Limited List	exp. A-B, B-C, C	location of sample measurements taken	
Station ID	N/A	Integer	0,1,2,3,4	identifier for multiple measurements in one reach	id 5 and 7 have added information included---station 0 is downstream end
Thalweg Depth	CM	Floating Point	XXX.X	flow path of deepest water in channel	100 to 150 equally spaced points from middle of channel-measured with calibrated rod
Wetted Width	Meters	Floating Point	XXX.X	measure at 0,5 and 7 pts of each transect for width of stream through selected reach	
Bar Width	Meters	Floating Point	XXX.X	width of bar if present	
Bar	N/A	Boolean	yes/no	indicator of bar presence	

<b>General Characteristic: Channel Condition</b>		<b>Specific Indicator Wetted Width</b>		<b>Domain Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Wetted Width</b>					
Stream ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Transect	N/A	Limited List	exp. A-B, B-C, C	location of sample measurements taken	
Station ID	N/A	Integer	0,1,2,3,4	identifier for multiple measurements in one reach	id 5 and 7 have added information included---station 0 is downstream end
Wetted Width 25%	Meters	Floating Point	XXX.X	25 % of total wetted width measured from LB	
Wetted Width 50%	Meters	Floating Point	XXX.X	50 % of total wetted width measured from LB	
Wetted Width 75%	Meters	Floating Point	XXX.X	75 % of total wetted width measured from LB	
Wetted Width Right Bank	Meters	Integer	XXX.X	Right bank of stream measured from LB	
Depth LB	Meters	Floating Point	XXX.X	depth at left bank	
Depth 25%	Meters	Floating Point	XXX.X	depth at 25% from left bank	
Depth 50%	Meters	Floating Point	XXX.X	depth at 50% from left bank	

<b>General Characteristic:</b> <b>Channel Condition</b>		<b>Specific Indicator</b> <b>Wetted Width</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Depth 75%	Meters	Floating Point	XXX.X	depth at 75% from left bank	
Depth RB	Meters	Floating Point	XXX.X	depth at right bank	

<b>General Characteristic:</b> <b>Channel Condition</b>		<b>Specific Indicator</b> <b>Bank Stability</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Bank Stability***

Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Transect	N/A	Limited List	exp. A-B, B-C, C	location of sample measurements taken	
Bank Angle Left	Degrees	Integer	0 - 360 degrees	angle of left stream bank	
Bank Angle Right	Degrees	Integer	0 - 360 degrees	angle of right stream bank	
Crumbling Percent	percent	Integer	0 - 100%	percent of transect showing crumbling	
Unvegetated Banks	percent	Integer	0 - 100%	percent of transect showing no vegetation	
Tree Root Exposure	percent	Integer	0 - 100%	percent of transect with tree roots showing	

<b>General Characteristic:</b> <b>Channel Condition</b>		<b>Specific Indicator</b> <b>Bankfull Width</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Bankfull Width***

Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Transect	N/A	Limited List	exp. A-B, B-C, C	location of sample measurements taken	
Incision Heights	Meters	Floating Point	XX.X	height from water surface to first terrace of floodplain	at or above Bankfull channel height
Bankfull Channel Height	Meters	Floating Point	XX.X	channel filled by moderate-sized flood events	happens every one or two years
Bankfull Channel Width	Meters	Floating Point	XX.X	width of channel filled by moderate sized flood events	

<b>General Characteristic: Riparian Condition</b>		<b>Specific Indicator Structure</b>		<b>Domain Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Structure</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Xsite-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Transect	N/A	Limited List	N/A	A-B,B-C etc. complete listing A-K	
Bankside	N/A	Variable Text	Left or Right	which side of stream was measurement taken from	
Vegetation Layer	N/A	Variable Text	Canopy, Underst	Canopy (>5m) - Understory (0.5 to 5m) - Ground Cover (<.5)	
Vegetation Type	N/A	Variable Text	D,C,E,M,N	D = deciduous, C = Coniferous, E = Broadleaf Evergreen, M = Mixed, N = None	
Big Trees	N/A	Variable Text	0,1,2,3,4	0 = Absent, 1 = Sparse, 2 = Moderate, 3 = Heavy, 4 = Very Heavy	used only under canopy description
Small Trees	N/A	Variable Text	0,1,2,3,4	0 = Absent, 1 = Sparse, 2 = Moderate, 3 = Heavy, 4 = Very Heavy	used only under canopy description
Woody Shrubs	N/A	Variable Text	0,1,2,3,4	0 = Absent, 1 = Sparse, 2 = Moderate, 3 = Heavy, 4 = Very Heavy	used only under understory description

<b>General Characteristic:</b> <b>Riparian Condition</b>		<b>Specific Indicator</b> <b>Structure</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Non-Woody Herbs	N/A	Variable Text	0,1,2,3,4	0 = Absent, 1 = Sparse, 2 = Moderate, 3 = Heavy, 4 = Very Heavy	used in both understory and ground cover descriptions
Barren, Bare Dirt	N/A	Variable Text	0,1,2,3,4	0 = Absent, 1 = Sparse, 2 = Moderate, 3 = Heavy, 4 = Very Heavy	used only under ground cover description
Flag	N/A	Variable Text	N/A	user comments	

<b>General Characteristic: Riparian Condition</b>		<b>Specific Indicator Disturbance</b>		<b>Domain Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b><i>Disturbance</i></b>					
Bankside	N/A	Variable Text	Left or Right	which side of stream	
Wall/Dike/Revetment/Riprap/Dam	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Buildings	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Pavement/Cleared Lots	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Roads/Railroads	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Pipe (inlet/Outlet)	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Landfill/Trash	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Park/Lawn	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Row Crops	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Pasture/ Range/ Hay Field	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Logging Operations	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Mining Activity	N/A	Variable Text	O, P, C, B	0 = Not Present, P = > 10m, C = within 10 m, B = On Bank	
Flag	N/A	Variable Text	N/A	user comments	

<b>General Characteristic:</b> <b>Riparian Condition</b>		<b>Specific Indicator</b> <b>Canopy Cover</b>		<b>Domain</b> <b>Transect Observation</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### **Canopy Cover**

CenUp	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream
CenL	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream
CenDwn	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream
CenR	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream
Lft	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream
Rgt	N/A	Integer	0 - 17 max	number of grid intersection points covered by vegetation	hold densiometer 1 ft above water surface facing downstream

<b>General Characteristic:</b> <b>Flows and Hydrology</b>		<b>Specific Indicator</b> <b>Streamflow</b>		<b>Domain</b> <b>Stream Flow</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Streamflow</b>					
Site ID	N/A	Variable Text	N/A	unique site id value given to research site	Site-ID Reach-ID
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Field Recorder	N/A	Variable Text	N/A	Name or initials of person recording information in the field	
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Flag	N/A	Variable Text	N/A	user comments	
Count of Stations	Count	Integer	XX.X	Count of stations measure along transect	
Measurement #	N/A	Integer	1,2,3,4,5 etc.	increment number of measurement taken	Repeated for each measurement station
Depth	Meters	Integer	XX.X	depth for each float reach	Repeated for each measurement station
Float Time	Seconds	Integer	X.X	determine time required for object to travel through segment	Repeated for each measurement station
Distance from Bank	Meters	Integer	XX.X	15 to 20 equal sized intervals across stream	Repeated for each measurement station -- final measurement should be left bank facing downstream
Velocity	Meters/Second	Integer	X.XX	value from rod	Repeated for each measurement station -- electromagnetic current meter-lowest time constant scale, impeller type meter-mid-position, "display averaging"
Section	N/A	Variable Text	upper, middle, lo	float section divided into 3 sections	used for greater accuracy

<b>General Characteristic:</b> <b>Flows and Hydrology</b>		<b>Specific Indicator</b> <b>Streamflow</b>		<b>Domain</b> <b>Neutral Buoyant Obje</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Float Distance	Meters	Integer	XX.X	length of segment	must allow for 10 to 30 second un-obstructed travel
Stream Size	N/A	Variable Text	N/A	classify stream size small, too small, very small	helps determine measurement procedure
Flag	N/A	Variable Text	N/A	Comments, questions	
Volume (L)	Liters	Floating Point	X.X	use calibrated bucket for measurement - 5 times /spillway	
Time	Seconds	Integer	X.X	determine time required to collect known volume of water	stopwatch is a must
Width	Meters	Integer	X.XX	width of stream for individual section	cross section of float reach

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Watershed Road Density</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### **Watershed Road Density**

Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Watershed Scale	N/A	Variable Text	3,4,5,6 filed wate	scale of watershed-helps determine what area will be concentrated on	
Watershed Name	N/A	Variable Text	N/A	name of watershed	
Watershed Area	Km2	Floating Point	XXXXXXXX.X	total area of watershed in kilometer	
Name of Road	N/A	Variable Text	N/A	name of road	
Length of Road Segment	Km	Floating Point	XXXXXXXX.X	length of road segment	
Total Road Length	Km	Floating Point	XXXXXXXX.X	total road length of entire watershed	
Road Density	Km/Km2	Floating Point	XXXXXX.XX	total road length/total area of watershed	
Data Origin	N/A	Variable Text	aerial photos, GI	where did road data originate?	
Road Data Name	N/A	Variable Text	N/A	name of road data, i.e.. If it's a shapefile please identify (metadata)	
Aerial Photo ID	N/A	Variable Text	N/A	flight line number	
Data Scale	Ft.	Floating Point	exp. 1:15000	helps determine density of roads-- scale at which road data was captured	
Aerial Photo Scale	Ft.	Floating Point	exp. 1:15000	helps determine density of roads	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Watershed Road Density</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Comments	N/A	Variable Text	N/A	data reviewer - person verifying the data	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Riparian-Road Index</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Riparian-Road Index</b>					
Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Watershed Scale	N/A	Variable Text	3,4,5,6 filed wate	scale of watershed-helps determine what area will be concentrated on	
Watershed Name	N/A	Variable Text	N/A	name of watershed	
Watershed Area	Km2	Floating Point	XXXXXXXX.X	total area of watershed in kilometer	
Name of Road	N/A	Variable Text	N/A	name of road	
Length of Road Segment	Km	Floating Point	XXXXXXXX.X	length of road segment	
Total Road Length	Km	Floating Point	XXXXXXXX.X	total road length of entire watershed	
Roads/Riparian Area	Km/Km2	Floating Point	XXXXXX.XX	total kilometers of roads within riparian areas	
Data Origin	N/A	Variable Text	aerial photos, GI	where did road data originate?	
Road Data Name	N/A	Variable Text	N/A	name of road data, i.e.. If it's a shapefile please identify (metadata)	
Aerial Photo ID	N/A	Variable Text	N/A	flight line number	
Data Scale	Ft.	Floating Point	exp. 1:15000	helps determine density of roads-- scale at which road data was captured	
Aerial Photo Scale	Ft.	Floating Point	exp. 1:15000	helps determine density of roads	
Riparian Areas ID	N/A	Variable Text	N/A	unique identifier for each area	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Riparian-Road Index</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Riparian Area	Km	Floating Point	XXXXXX.XX	area of each riparian area	
Streams length/Watershed	Km	Floating Point	XXXXXX.XX	total length of streams in entire watershed	
Riparian Road Index	Km/Km2	Floating Point	XXXXXX.XX	riparian roads total/stream total	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Land Ownership</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Land Ownership***

Reviewer	N/A	Variable Text	N/A	data reviewer - person verifying the data	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Survey Start Date	Calendar Day	Date	dd/mm/yyyy	Starting date of survey	
Survey End Date	Calendar Day	Date	dd/mm/yyyy	Ending date of survey	
Study Area ID	N/A	Variable Text	N/A	unique id for study area	
Study Area Description	N/A	Variable Text	N/A	description of study area	lats/longs---near interstate....five miles up road etc.
Area	sq miles	Floating Point	XXXXXX.XX	area of owned property	
Acres	sq acres	Floating Point	XXXXXX.XX	acres of owned property	
Agency	N/A	Variable Text	N/A	name of owner/agency	exp. John Brown or The Space Group etc
Contact Number Address	N/A	Variable Text	exp. 4500	number address of contact	
Contact Adir	N/A	Variable Text	North, East, West	direction of address. Exp. 4500 EAST Burlington Way	
Contact Street Name Address	N/A	Variable Text	exp. Burlington	street name address	
Contact Street Type	N/A	Variable Text	Street, Road, Ave	what kind of street	
Contact City	N/A	Variable Text	N/A	contact city name	
Contact State	N/A	Variable Text	N/A	contact state name	
Contact Zip	N/A	Variable Text	XXXXXX-XXXX	8 number zip ---4number access if available	
PLS Available	N/A	Variable Text	yes/no	is the PLS info available	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Land Ownership</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Township	N/A	Integer	XXX	township number	
Tdir	N/A	Variable Text	N (North) or S (S	direction of township	
Range	N/A	Integer	XXX	range number	
Rdir	N/A	Variable Text	W (West) or E (E	direction of range	
Comments	N/A	Variable Text	N/A	data reviewer - person verifying the data	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Land Use</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Land Use</b>					
Study Area ID	N/A	Variable Text	N/A	unique id for study area	
Data Collector	N/A	Variable Text	N/A	initials of data collector	
Study Area Description	N/A	Variable Text	N/A	description of study area	lat/long---etc....interstate...five miles up road etc.
Media Type	N/A	Variable Text	satellite, aerial ph	what type of images, photos are being used?	
Image Dates	Calendar Day	Date	dd/mm/yyyy	Dates of images used	
Aerial Photo Date	Calendar Day	Date	dd/mm/yyyy	Dates of images used	
Aerial Photo Type	N/A	Variable Text	color, black and	aerial photo type	
Percent Cloud Free	%	Floating Point	XXX%	percent if image that has no clouds	
Scale of Data	Meters	Variable Text	exp. 1:15000	scale at which data was captured	
Contact Info	N/A	Variable Text	N/A	where was the data received from	
Study Area Area	Km	Floating Point	XXXXXX.XX	area that study area covers	
Level 1 Land Use	N/A	Variable Text	Nonvegetation, a	classes of land use	Nonvegetation- lands including those within urban city boundaries, water bodies, barren areas, rock and exposed soil agriculture- lands actively in fields crops or fallow, hay, vegetables, grazing pastures and feedlots
Level 2 Land Use	N/A	Variable Text	N/A	sub-classes that can be interpreted per watershed	since all watersheds are different- nc specific classification is given-must fit in major categories in Level 1 Land Use
Percent Coverage Level 1	%	Floating Point	XXX%	percent of total watershed study area land use type covers	

<b>General Characteristic:</b> <b>Watershed Condition</b>		<b>Specific Indicator</b> <b>Land Use</b>		<b>Domain</b> <b>Watershed Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Percent Coverage Level 2	%	Floating Point	XXX%	percent of total watershed study area land use type covers	
Comments	N/A	Variable Text	N/A	data reviewer - person verifying the data	

<b>General Characteristic: X-Site</b>		<b>Specific Indicator Site Information</b>		<b>Domain Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Site Information</b>					
Site ID	N/A	Variable Text	N/A	Index Site, X-site id	Produced by EMAP sampling routines, the approxiamte mid point of the sample reach
Located By	N/A	Variable Text	N/A	initials of person who located point	
Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site latitude in decimal degrees	From Emap sampling routines site
Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site longitude in decimal degrees	From Emap sampling routines site
GPS Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	assessment site latitude in decimal degrees	Location of beginning of survey
GPS Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	assessment site longitude in decimal degrees	Location of beginning of survey
Access Route	N/A	Spatial/text	N/A	Directions to sample site	Site access routes can be developed using available DRG's, DOQ's, and other spatial data
Distance Left Bank	Meters	Integer	XX.XX	distance from left bank at each cross-section	
Distance Right Bank	Meters	Integer	XX.XX	distance from right bank at each cross-section	
Survey Reach Lower Boundary Monu	N/A	Variable Text	N/A	landmark showing lower boundary	
Survey Reach Upper Boundary Monun	N/A	Variable Text	N/A	landmark showing upper boundary	
Project Code	N/A	Variable Text	N/A	code descriptor of project	

<b>General Characteristic: X-Site</b>		<b>Specific Indicator Site Verification</b>		<b>Domain Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Site Verification</b>					
Verification Data	Date and Time	Date Time	dd/mm/yyyy hou	Date site verification visit was made	
GPS Verification	Yes/No	Boolean	N/A	Yes if site location is verified by GPS	
Local Contact Verification	Yes/No	Boolean	N/A	Yes if site location is verified by local contacts	
Signs Verification	Yes/No	Boolean	N/A	Yes if site location is verified by signs	
Roads	Yes/No	Boolean	N/A	Yes if site location is verified by relation to roads	
Topo Map	Yes/No	Boolean	N/A	Yes if site location is verified by topo map	
Not Verified	Yes/No	Boolean	N/A	Yes if site location is NOT verified	
Other Verification	Yes/No	Boolean	N/A	Yes if site location is verified by other means	
Verification Descriptions	N/A	Variable Text	N/A	Written description of the non standard verification method that was used	
GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site latitude in decimal degrees from GPS unit taken on site. Minimum 4 decimal places	GPS Coordinates from visit--could be map coordinates
GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	Index Site longitude in decimal degrees from the GPS unit taken on site	GPS Coordinates from visit--could be map coordinates
GPS Precision	RMS/PDOP	Floating Point	X.XX	GPS precision indications such as PDOP or RMS location error	Specific precision indicator can be determined later
Sampleable	Yes/No	Boolean	N/A	Yes-- is site suitable for sampling	

<b>General Characteristic:</b> <b>X-Site</b>		<b>Specific Indicator</b> <b>Site Verification</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Sample Categories	Boatable; Boatab	Limited List	N/A	List of site categories / conditions if site is sampleable	
Non-Sampleable	Yes/No	Boolean	N/A	Yes- is site NOT suitable for sampling	
NonSample Categories	Dry channel; wetl	Variable Text	N/A	List of site categories/ conditions if site is not sampleable	
No Access	Yes/No	Boolean	N/A	Yes - if site is NOT accessible	
No Access Categories	Permission Denie	Limited List	N/A	Status or access denied	
Site Comments	N/A	Variable Text	N/A	Comment field for site comments	

<b>General Characteristic:</b>		<b>Specific Indicator</b>		<b>Domain</b>	
<b>X-Site</b>		<b>Site Photographs</b>		<b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Site Photographs***

Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	

<b>General Characteristic:</b> <b>X-Site</b>		<b>Specific Indicator</b> <b>Site Layout</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Site Layout</b>					
Channel Width 1	Meters	Floating Point	0.1 meters	One of five wetted width measurements	
Channel Width 2	Meters	Floating Point	0.1 meters	One of five wetted width measurements	
Channel Width 3	Meters	Floating Point	0.1 meters	One of five wetted width measurements	
Channel Width 4	Meters	Floating Point	0.1 meters	One of five wetted width measurements	
Channel Width 5	Meters	Floating Point	0.1 meters	One of five wetted width measurements	
Channel Width Average	Meters	Floating Point	0.1 meters	Average of the 5 wetted width measurements	
Sample Reach Length	Meters	Floating Point	1.0 Meters	Total length of sample reach - 40 times the channel width average	Minimum sample reach sitance is 150m
Reach Shift	Meters	Floating Point	1.0 Meters	Distance X-Site is shifted due to confluences, lakes, ponds, etc.	
Reach Shift Direction	N/A	Limited List	N/A	Up = upstream shift, Down - downstream shift	
Transect Distance	Meters	Floating Point	1.0 Meters	Distance between each of the 11 sampling transects, 1/10 of the sample reach length	
TranA_SampleSite	N/A	Limited List	Left, Center, Rig	Sampling point location determined at random for A and assigned sequentially for other transects, in order of L,C,R	
Upper GPS Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
Upper GPS Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey

<b>General Characteristic:</b> <b>X-Site</b>		<b>Specific Indicator</b> <b>Site Layout</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Upper Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Upper Bank Side	N/A	Variable Text	N/A	Stream side of upper monumentation (looking downstream)	
Lower GPS Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
Lower GPS Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey
Lower Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Lower Bank Side	N/A	Variable Text	N/A	Stream side of upper monumentation (looking downstream)	
Layout Comments	N/A	Variable Text	N/A	Comments	

<b>General Characteristic:</b> <b>X-Site</b>		<b>Specific Indicator</b> <b>Site Transects</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### **Site Transects**

Transect 1-10 GPS Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
Transect 1-10 GPS Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	location of beginning of survey
Transect 1-10 GPS Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Transect 1-10 GPS Bank Side	N/A	Variable Text	N/A	Stream side of upper monumentation (looking downstream)	
Transect 1-10 GPS Comments	N/A	Variable Text	N/A	Comments	
Site Sketch	N/A	Graphic / Spatial	N/A	Sketch map of site and transects	Can use aerial photos or DOQ's as base map for the sketch
Layout Comments	N/A	Variable Text	N/A	Comments	

<b>General Characteristic:</b> <b>X-Site</b>		<b>Specific Indicator</b> <b>Verification Team</b>		<b>Domain</b> <b>Sample Site</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>

### ***Verification Team***

TeamID	N/A	Variable Text	N/A	Identification code for field team	
Person1	N/A	Variable Text	N/A	Name of team person one	List all members of the project team
Pers1_duties	N/A	Limited List	Biomorph, Geom	Duties of person one	
PersonX	N/A	Variable Text	N/A	Name of team person X	List all members of the project team
PersonX_Duties	N/A	Limited List	Biomorph, Geom	Duties of person X	

<b>General Characteristic:</b> <b>Point Sample</b>		<b>Specific Indicator</b> <b>Sample_Point</b>		<b>Domain</b> <b>Sample Point</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Sample_Point</b>					
Site ID	N/A	Variable Text	N/A	point id	
Geo Link	N/A	Variable Text	N/A	links to GIS information	
GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey
GPS PDOP	PDOP	Floating Point	X.XX	GPS precision indications -- PDOP error	Specific precision indicator can be determined later
GPS RMS Error	RMS	Floating Point	X.XX	GPS precision indications -- RMS location error	Specific precision indicator can be determined later
Bankside	N/A	Variable Text	left, right	which side of stream is point located on	
Distance from Bank	Meters	Integer	XX.XX	distance from bank	
Located By	N/A	Variable Text	N/A	initials of person who located point	
Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Sketch Map	N/A	Graphic / Spatial	N/A	Sketch map of site and transects	Can use aerial photos or DOQ's as base map for the sketch
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Directions	N/A	Variable Text	N/A	directions to point location	

<b>General Characteristic:</b> <b>Point Sample</b>		<b>Specific Indicator</b> <b>Sample_Point</b>		<b>Domain</b> <b>Sample Point</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well

<b>General Characteristic: Cross-Sectional Transects</b>		<b>Specific Indicator Transect</b>		<b>Domain Transect</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Transect</b>					
Site ID	N/A	Variable Text	N/A	point id	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Geo Link	N/A	Variable Text	N/A	links to GIS information	
GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey
GPS PDOP	PDOP	Floating Point	X.XX	GPS precision indications -- PDOP error	Specific precision indicator can be determined later
GPS RMS Error	RMS	Floating Point	X.XX	GPS precision indications -- RMS location error	Specific precision indicator can be determined later
Bankside	N/A	Variable Text	left, right	which side of stream is point located on	
Distance from Bank	Meters	Integer	XX.XX	distance from bank	
Located By	N/A	Variable Text	N/A	initials of person who located point	
Wetted Width	Meters	Integer	XXX.X	average width of stream through selected reach	
Bankfull Channel Width	Meters	Floating Point	XXXXXX.XX	width of stream at normal high water	
Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Sketch Map	N/A	Graphic / Spatial	N/A	Sketch map of site and transects	Can use aerial photos or DOQ's as base map for the sketch
Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well

<b>General Characteristic:</b> <b>Cross-Sectional Transects</b>		<b>Specific Indicator</b> <b>Transect</b>		<b>Domain</b> <b>Transect</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	

<b>General Characteristic:</b> <b>Reach Sample Site</b>		<b>Specific Indicator</b> <b>Reach</b>		<b>Domain</b> <b>Reach-Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
<b>Reach</b>					
Site ID	N/A	Variable Text	N/A	point id	
Project Code	N/A	Variable Text	N/A	code descriptor of project	
Geo Link	N/A	Variable Text	N/A	links to GIS information	
Upstream GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
Downstream GPS_Latitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site latitude in decimal degrees	Location of beginning of survey
Downstream GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey
Upstream GPS_Longitude	Decimal Degrees	Floating Point	Seconds, 1.0000x	accessment site longitude in decimal degrees	Location of beginning of survey
Downstream GPS PDOP	PDOP	Floating Point	X.XX	GPS precision indications -- PDOP error	Specific precision indicator can be determined later
Upstream GPS PDOP	PDOP	Floating Point	X.XX	GPS precision indications -- PDOP error	Specific precision indicator can be determined later
Downstream GPS RMS Error	RMS	Floating Point	X.XX	GPS precision indications -- RMS location error	Specific precision indicator can be determined later
Upstream GPS RMS Error	RMS	Floating Point	X.XX	GPS precision indications -- RMS location error	Specific precision indicator can be determined later
Upstream Bankside	N/A	Variable Text	left, right	which side of stream is point located on	
Downstream Bankside	N/A	Variable Text	left, right	which side of stream is point located on	
Downstream Distance from Bank	Meters	Integer	XX.XX	distance from bank	
Upstream Distance from Bank	Meters	Integer	XX.XX	distance from bank	

<b>General Characteristic:</b> <b>Reach Sample Site</b>		<b>Specific Indicator</b> <b>Reach</b>		<b>Domain</b> <b>Reach-Wide</b>	
<b>Attribute</b>	<b>Units</b>	<b>Data Type</b>	<b>Precision</b>	<b>Description</b>	<b>Comment</b>
Downstream Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Main Channel Length	Meters	Floating Point	XXXX.XX	length of main channel	can be taken from map
Upstream Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Located By	N/A	Variable Text	N/A	initials of person who located point	
Wetted Width	Meters	Integer	XXX.X	average width of stream through selected reach	
Bankfull Channel Width	Meters	Floating Point	XXXXX.XX	width of stream at normal high water	
Monumentation	N/A	Variable Text	N/A	Description of established monumentation	Survey flagging, Rebar, Cairn, Slash
Sketch Map	N/A	Graphic / Spatial	N/A	Sketch map of site and transects	Can use aerial photos or DOQ's as base map for the sketch
Photograph ID	N/A	Variable Text	N/A	ID for photograph	digital cameras work well
PhotoTime	Date and Time	Date Time	dd/mm/yyyy hou	time of photograph	
Photo Subject	N/A	Variable Text	N/A	Subject/purpose of the photograph	
Photo Comments	N/A	Variable Text	N/A	Comment field for the photograph	